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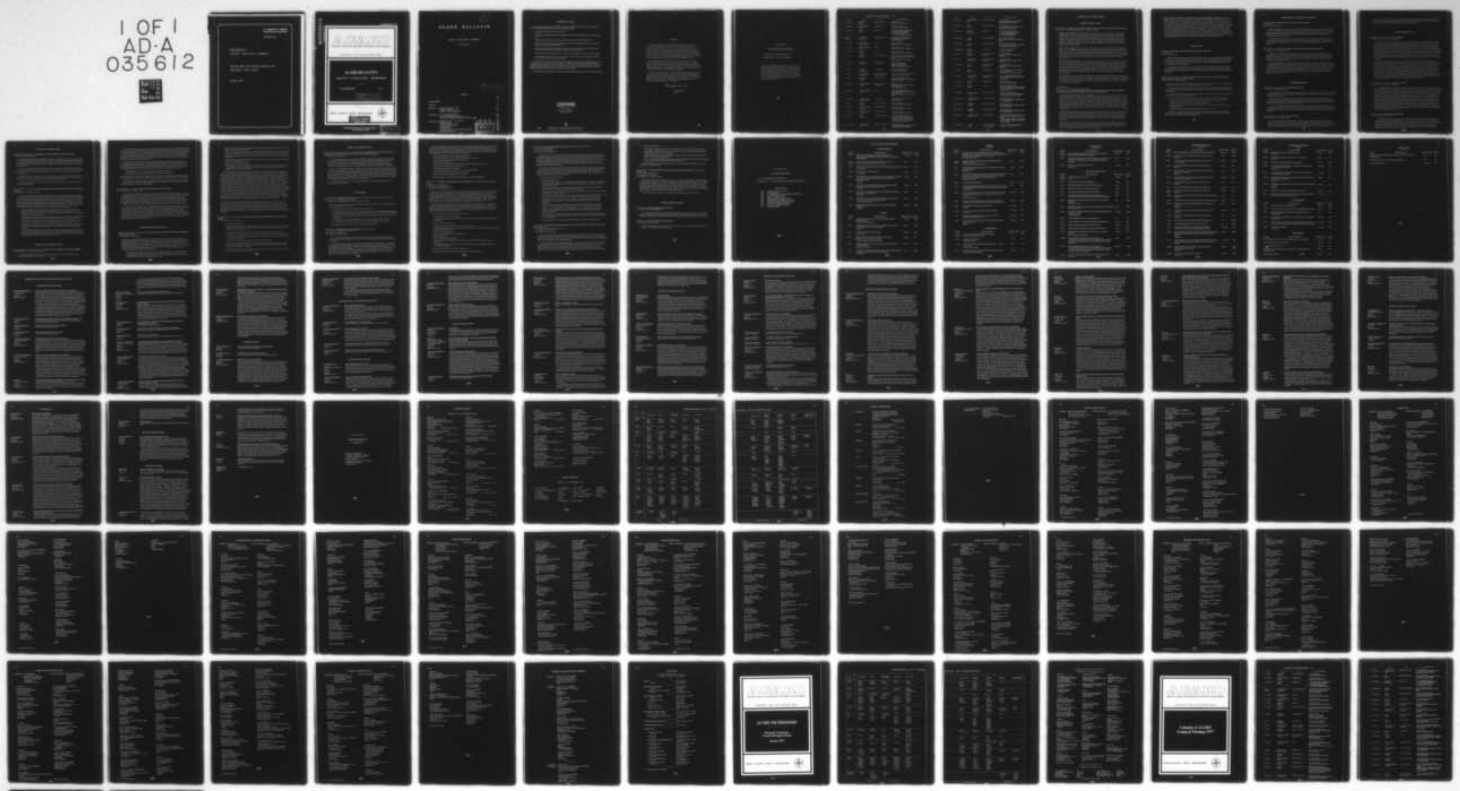

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AGARD BULLETIN

MEETINGS - PUBLICATIONS - MEMBERSHIP

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS, FRANCE

JANUARY 1977

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AGARD

ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

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MEETINGS · PUBLICATIONS · MEMBERSHIP

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AGARD BULLETIN

MEETINGS · PUBLICATIONS · MEMBERSHIP

JANUARY 1977

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THE MISSION OF AGARD

The mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes:

- Exchanging of scientific and technical information;
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
- Providing scientific and technical advice and assistance to the North Atlantic Military Committee in the field of aerospace research and development;
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field;
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential;
- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community.

The highest authority within AGARD is the National Delegates Board consisting of officially appointed senior representatives from each member nation. The mission of AGARD is carried out through the Panels which are composed of experts appointed by the National Delegates, the Consultant and Exchange Program and the Aerospace Applications Studies Program. The results of AGARD work are reported to the member nations and the NATO Authorities through the AGARD series of publications of which this is one.

Participation in AGARD activities is by invitation only and is normally limited to citizens of the NATO nations.

Published January 1977

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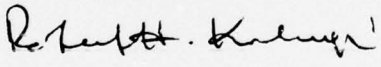
PREFACE

AGARD accomplishes its mission through the programs of the Panels, the Consultant and Exchange Division and the Military Committee Studies Division. The Panel programs of AGARD are conducted at meetings which are organized as conferences, symposia, specialists meetings, or working group meetings, and planned at business meetings. The Consultant and Exchange Division organizes Lecture Series and Short Courses as well as providing individual consultants to the nations and AGARD Panels. The Military Committee Studies Division organizes and participates in Technology Studies conducted by the Panels and special Aerospace Applications Studies; both types of studies are requested by or through the North Atlantic Military Committee.

This AGARD Bulletin contains information on all the planned 1977 AGARD meetings including dates, locations and brief descriptions of their themes. Additional specific information will be provided by means of individual Meeting Announcements which will be distributed by the various Panels. Queries about participation in AGARD meetings can be addressed to the appropriate Panel Members or National Delegates whose names and addresses are listed in Section III of this Bulletin.

Included in this Bulletin is also a list of all AGARD Publications which were released in 1976, together with their abstracts. Complete listings of all AGARD Publications which appeared since the founding of this agency are included in the "AGARD Index of Publications 1952-1970" and the "AGARD Index of Publications 1971-1973", which are updated by Annual Supplements. Information on how AGARD documents may be obtained is given on the back cover of this Bulletin.



Robert H.Korkegi
Director

SECTION I

1977 AGARD TECHNICAL MEETINGS

- CALENDAR OF AGARD MEETINGS 1977
- SUMMARY OF 1977 MEETING THEMES

Attendance at AGARD Panel Meetings and Lecture Series is by invitation only and is normally limited to citizens of the NATO Nations. Applications should be made to an AGARD National Delegate or Panel Member from the applicant's own country. Citizens of the Federal Republic of Germany or of the United States of America must apply respectively through the appropriate German or US Panel Coordinator. The names and addresses of National Delegates and Panel Members will be found in Section III of this Bulletin.

CALENDAR OF AGARD MEETINGS – 1977

Date	*Location*	*Activity*	*Type of Meeting/Subject*
21–23 March	BELGIUM (Brussels)	Fluid Dynamics/VKI	Lecture Series No.86 **Computational Fluid Dynamics**
25–27 April	UNITED STATES (Dayton)	Fluid Dynamics	Lecture Series No.86 **Computational Fluid Dynamics**
23–25 March	FRANCE (Paris)	Headquarters	42nd **National Delegates Board Meeting** 24th **Steering Committee Meeting** 22nd **Panel Chairmen Meeting** 7th **National Co-ordinators Meeting**
28 March/ 1 April	NETHERLANDS (The Hague)	Propulsion & Energetics	49th Panel Meeting/Specialists' Meetings **Secondary Flow in Turbomachines** **Power Plant Reliability**
14–15 April	UNITED STATES (Griffiss AFB)	Avionics	Lecture Series No.87 **Microprocessors and Their Applications**
18–19 April	UNITED KINGDOM (London)	Avionics	Lecture Series No.87 **Microprocessors and Their Applications**
21–22 April	GERMANY (Munich)	Avionics	Lecture Series No.87 **Microprocessors and Their Applications**
17–22 April	PORTUGAL (Lisbon)	Structures & Materials	44th Panel Meeting/Specialists' Meetings **Unsteady Airloads in Separated and Transonic Flow** **Structural Aspects of Active Controls**
18–22 April	GERMANY (Porz-Wahn)	Aerospace Medical	Specialists' Meetings **Methods to Assess Workload** **Studies on Pilot Workload** **The Use and Abuse of Social Drugs**
2–5 May	DENMARK (Copenhagen)	Fluid Dynamics	40th Panel Meeting/Symposium ***Laminar-Turbulent Transition***
2–11 May	NETHERLANDS (The Hague)	Aerospace Applications Studies Committee	Aerospace Applications Studies Committee Meeting No.13 and Working Groups
9–13 May	GERMANY (Stuttgart)	Guidance & Control	24th Panel Meeting/Symposium **Applications of Advances in Navigation to Guidance and Control**
16–20 May	UNITED KINGDOM (London)	Electromagnetic Wave Propagation	Symposium **Optical Fibres/Integrated Optics and Their Military Applications** (Joint with Avionics Panel)
16–20 May	UNITED KINGDOM (London)	Avionics	33rd Panel Meeting/Symposium **Optical Fibres/Integrated Optics and Their Military Applications** (Joint with Electromagnetic Wave Propagation Panel)
16–20 May	UNITED STATES (Moffett Field, Ca)	Flight Mechanics	50th Panel Meeting/Symposium **Rotorcraft Design**
6–7 June	NORWAY (Bolkesjø)	Guidance & Control	Lecture Series No.89 **Task Oriented Flight Control Systems**
9–10 June	UNITED KINGDOM (London)	Guidance & Control	Lecture Series No.89 **Task Oriented Flight Control Systems**
14–15 June	UNITED STATES (Dayton)	Guidance & Control	Lecture Series No.89 **Task Oriented Flight Control Systems**
22–24 June	NORWAY (Lysebu)	Technical Information	30th Panel Meeting/Symposium **The Impact of Future Developments in Communications, Information Technology and National Policies on the Work of the Aerospace Information Specialist**
25–26 August	UNITED STATES (Trenton, N.J.)	Propulsion & Energetics	Lecture Series No.90 **Laser Optical Measurement Methods for Aero Engine Research and Development**

Date	*Location*	*Activity*	*Type of Meeting/Subject*
30–31 August	UNITED KINGDOM (London)	Propulsion & Energetics	Lecture Series No.90 **Laser Optical Measurement Methods for Aero Engine Research and Development**
5–6 September	ITALY (Urbino)	Propulsion & Energetics	Lecture Series No.90 **Laser Optical Measurement Methods for Aero Engine Research and Development**
14–16 September	DENMARK (Copenhagen)	Headquarters	13th Panel Meeting/Symposium 43rd **National Delegates Board Meeting** 25th **Steering Committee Meeting** 23rd **Panel Chairmen Meeting**
19–23 September	TURKEY (Ankara)	Propulsion & Energetics	50th Panel Meeting/Symposium **High Temperature Problems in Gas Turbine Engines**
25–30 September	NORWAY (Geilo)	Structures & Materials	45th Panel Meeting/Symposium **Non-Destructive Inspection (NDI) Relationships to Aircraft Design and Materials**
26–30 September	CANADA (Ottawa)	Fluid Dynamics	41st Panel Meeting/Symposium **Unsteady Aerodynamics**
3–4 October	NORWAY (Oslo area)	Electromagnetic Wave Propagation	Lecture Series No.88 **Application of Remote Sensing to Ocean Surveillance**
6–7 October	NETHERLANDS (Den Helder)	Electromagnetic Wave Propagation	Lecture Series No.88 **Application of Remote Sensing to Ocean Surveillance**
11–12 October	ITALY (Rome)	Electromagnetic Wave Propagation	Lecture Series No.88 **Application of Remote Sensing to Ocean Surveillance**
3–7 October	ITALY (Florence)	Flight Mechanics	51st Panel Meeting and Inter-Panel Symposium **Fighter Aircraft Design** (with ASMP, AVP, FDP, GCP, PEP, SMP)
3–7 October	UNITED STATES (Cambridge)	Electromagnetic Wave Propagation	24th Panel Meeting/Specialists' Meeting **Aspects of Electromagnetic Scattering in Radio-communications**
11–13 October	FRANCE (Paris)	Flight Mechanics	Specialists Meeting **Performance Prediction Methods**
10–14 October	CANADA (Ottawa)	Avionics	34th Panel Meeting/Symposium **Impact of Charge Coupled Devices and Acoustic Wave Devices on Signal Processing and Imagery in Advanced Systems**
17–21 October	UNITED STATES (Dayton)	Guidance & Control	25th Panel Meeting/Symposium **Guidance and Control Design Consideration for Low Altitude and Terminal Area Flight**
17–18 October	UNITED KINGDOM (London)	Structures & Materials	Lecture Series No.91 **Advanced Manufacturing Techniques in Joining of Aerospace Materials**
20–21 October	GERMANY (Munich)	Structures & Materials	Lecture Series No.91 **Advanced Manufacturing Techniques in Joining of Aerospace Materials**
24–25 October	DENMARK (Lyngby)	Structures & Materials	Lecture Series No.91 **Advanced Manufacturing Techniques in Joining of Aerospace Materials**
24–28 October	UNITED KINGDOM (London)	Aerospace Medical	34th Panel Meeting/Specialists' Meetings **Prospective Medicine Opportunities in Aerospace Medicine** **Specific Findings in Cardiology and Pulmonary Function with Special Emphasis on Assessment Criteria for Flying**
7–17 November	FRANCE (Paris)	Aerospace Applications Studies Committee	Aerospace Applications Studies Committee Meeting No.14 and Working Groups

SUMMARY OF 1977 MEETING THEMES

AEROSPACE MEDICAL PANEL

Specialists Meeting: **Methods to Assess Workload. Studies on Pilot Workload. The Use and Abuse of Social Drugs.**
18–22 April 1977, DFVLR, Linderhöhe 5000, Cologne 90, Germany.

Methods to Assess Workload – With the evolution of advanced aircraft and the emergence of multi-mission concepts and roles, pilot workload has become of increasing concern: the measurement of workload poses many problems. A wide variety of methods are employed, frequently in an interdisciplinary setting. This meeting will cover the full spectrum of aerospace medical sciences on the topic of methods to assess aircrew workload. The papers will be method-oriented, but will include studies which illustrate the way in which the methods work. Particular emphasis will be given to reliability, validity, sensitivity to workload parameters, inflight and simulator study methods, and to those methods yielding data directly applicable without further translation to operational problems.

Studies on Pilot Workload – Pilot workload is a continuing area of concern in the NATO research community because it can be a limiting factor in the more demanding missions. Factors which are significant include type aircraft, mission profiles, multiple operational stresses, workload demands compounded by the stresses of the flight deck/cockpit environment, unique workloads and performance demands posed by the avionics, navigational, and weapons delivery systems. The meeting will deal with these topics and with techniques to reduce workload or ameliorate the combined effects of workload and stress. Particular interest will be given to inflight and simulator studies.

The Use and Abuse of Social Drugs – The individual nations' experience differs on the incidence of drug-taking in their military organizations though there is undoubted knowledge that there is some use of drugs in all. This may vary from an extensive use of alcohol and tobacco to the minimal consumption of illegal substances. It is considered that the exchange of information could lead to the identification of problems hitherto thought to be non-existent and that those nations without a problem may point the way to its alleviation in others. Should drug use or abuse occur in flying personnel or ground crew, flight safety will be adversely affected. The meeting may bring to light effective measures to reduce morbidity and even mortality from the use of these social drugs.

The meeting will cover: the use and abuse of drugs which are taken for their social effect (.: such as alcohol, stimulants, tobacco, marijuana, addictive, hallucinogenic, psychogenic substances and combinations), pharmacology and epidemiology in the human subject, social changes and behavioral patterns in users; the effects of poly drug use; long term effects of drug administration; problems of the detection of drug users and abusers; preventive action and resolution of the habit.

34th Panel Meeting
24–28 October 1977, Church House, London, England
Specialists Meeting: **Prospective Medicine Opportunities in Aerospace Medicine. Specific Findings in Cardiology and Pulmonary Function with Special Emphasis on Assessment Criteria for Flying.**

Prospective Medicine Opportunities in Aerospace Medicine – The purpose of prospective medicine is to identify the propensity for disease development at a stage long before clinical pathology can be detected and then to intervene in the process to positively modify prognosis. These goals offer an excellent opportunity to extend the delivery of medical care in the military well beyond the current concepts of preventive medicine, the routine physical examination, and the treatment of existing disease states despite marginal medical manpower resources. Proper utilization of currently available data related to readily identifiable risk factors would allow concentration of medical interest within the relatively small segment of the population from which the majority of medical problems will become manifest without sacrifice of good medical care for the remainder and without detriment to flying safety.

In addition, prospective medicine promotes intervention in disease process before the disease becomes clinically significant and thus offers a real opportunity to significantly reduce manpower losses from disease. Specific identification of risk factors in the individual offers greater motivation to modify risk through specific educational and clinical efforts than do broad, general guidelines as usually practiced. The prospective medicine approach could also form the basis for significant revision of selection and retention criteria for the military aircrewman.

This meeting will cover applications of prospective medicine techniques to aerospace medicine; studies in the special population of military aircrew on the prevelance/incidence of findings; correlation of findings with disease risks; results of multiple risk assessment, epidemiologic studies; natural history of findings; and the results of educational and clinical efforts to modify risk for disease.

Specific Findings in Cardiology and Pulmonary Function with Special Emphasis on Assessment Criteria for Flying – Cardiopulmonary diseases constitute the most significant health problem in the military forces of the NATO countries in terms of deaths and premature disability. The cost of these diseases to the military forces is very significant when viewed either in monetary terms or in mission capability. And yet, because of the select nature of the military population much of the medical information gathered in civilian hospital populations concerning the significance of medical findings is not directly applicable to the military population. There has been excellent progress made over the past several years in definition of the significance of medical findings with respect to continued military duty. This topic should produce a review and update of specific problems in the cardiopulmonary arena and improve application of new information by each country. The meeting will deal with normal values in the military population for cardiovascular and pulmonary function; correlation studies of common findings with disease states; studies of the natural history of findings along with their influence on military performance and the effect of special aspects of military duty upon the disease process.

AVIONICS PANEL

Symposium: **Optical Fibres, Integrated Optics and Their Military Applications**
Joint AVP/EPP
16–20 May, London, UK

Rapid developments in laser semiconductors and low loss optical fibres are responsible for new applications in the areas of communication, imaging and data transmission in general. Optical fibres provide a high degree of communication security, freedom from electronic interference, large length-bandwidth product, and system miniaturization through their small size. The combination of all these features leads to new concepts and unique applications in military hardwares.

The purpose of this conference is to review and present the latest developments in fibres and integrated optics, stressing their military applications and emphasizing the topics of major interest to the Avionics and Electromagnetic Wave Propagation Panels: End Devices, Coupling and Propagation Mechanisms, Optical Cables and Systems.

34th Panel Meeting – Symposium: **Impact of Charge Coupled Devices and Surface Accoustic Wave Devices on Signal Processing and Imagery in Advanced Systems**
10–14 October 1977, Ottawa, Canada

In recent years the technology of charge coupled devices and surface acoustic waves has expanded rapidly leading the way to new concepts in imagery and signal processing techniques.

Several symposia have been held in the past on each subject and others are planned. The Symposium will make a general survey of both techniques and their applications and of assessing their impact on the design of advanced systems.

The symposium will be mainly devoted to practical applications and achievements. The authors will make specific efforts to answer the following questions:

- Why these new techniques have been preferred to digital techniques in their specific applications,
- Generally speaking, are these techniques competing with digital techniques and in which field,
- What are the advantages to be expected from their extensive use,
- Are CCD and SAW techniques competing or complementary – What are the most appropriate areas of application for each,
- Are further improvements and developments expected in the near future?

The impact of these new techniques on the design of systems will be strongly emphasized. Fields of particular interest are signal processing and imaging in radar, communications, television, forward-looking infra-red, linescan, computers and other military systems.

ELECTROMAGNETIC WAVE PROPAGATION PANEL

Symposium: **Optical Fibres, Integrated Optics and Their Military Applications**
Joint EPP/AVP
16–20 May 1977, London, UK

Rapid developments in laser semiconductors and low loss optical fibres are responsible for new applications in the areas of communication, imaging and data transmission in general. Optical fibres provide a high degree of communication security, freedom from electronic interference, large length-bandwidth product, and system miniaturization through their small size. The combination of all these features leads to new concepts and unique applications in military hardwares.

The purpose of this conference is to review and present the latest developments in fibres and integrated optics, stressing their military applications and emphasizing the topics of major interest to the Avionics and Electromagnetic Wave Propagation Panels: End Devices, Coupling and Propagation Mechanisms, Optical Cables and Systems.

24th Panel Meeting – Symposium: **Aspects of Electromagnetic Scattering in Radiocommunications**
3–7 October 1977, Cambridge, Mass, USA

Scattering and reflections of electromagnetic waves by the inhomogeneities and discontinuities of the troposphere and of the ionosphere has been studied intensely in the last quarter of a century. Besides the interest of such studies from a geophysical point of view, a strong motivation has been to make use of scatter propagation for communicating over the horizon at mainly VHF and UHF frequencies normally unsuitable beyond optical and diffraction range.

The Symposium will be concerned with the theory of scattering and reflections from irregularities in the troposphere and the ionosphere including the prediction of short and long-term signal characteristics, and with the characterization of radio channels using such modes of propagation. It will also cover the effects of terrain, meteorological and other environmental factors on propagation as well as the methods and techniques which may be used in the design of scatter communications which are efficient, both in the usage of power and frequency spectrum. The Symposium is thus intended for geophysicists, communication system planners and designers as well as for the user.

FLUID DYNAMICS PANEL

40th Panel Meeting – Symposium: **Laminar-Turbulent Transition**
2–5 May 1977, Copenhagen, Denmark

The physical fluid mechanical phenomena involving the process of transition of a fluid from a laminar state through a transitional regime and ultimately to a fully developed turbulent flow has been the subject of numerous research studies and activities.

The primary purpose of the meeting will be to review the progress achieved in the past several years relating to experimental and theoretical studies and analysis of the transition phenomena. Particular emphasis will be centered on calculation methods for predicting the onset and transitional development of shear flows, including stability parameters, criteria and initial conditions.

Recent and innovative instrumentation and measurement techniques for determining flow parameters in the laminar-transitional regime will be discussed, as well as visual observation methods. The influence of suction, pressure gradients, roughness and other factors on the stability of incompressible and compressible flows will be discussed.

41st Panel Meeting – Symposium: **Unsteady Aerodynamics**
26–30 September 1977, Ottawa, Canada

The increased requirement for high performance, high lifting, maneuverable aircraft and other aerospace vehicles results in aerodynamic flow conditions with severe pressure gradients, shock wave boundary-layer interactions, and non-linear effects with resultant unsteady boundary layers and inviscid flows. This unsteadiness can have a pronounced effect on the aerodynamic characteristics of lifting surfaces (including controls).

Specific areas to be addressed include unsteady subsonic and supersonic inviscid flows (including non-linear effects) unsteady transonic flows, unsteady non-separated and separated boundary layers, viscous-inviscid interactions, and associated unsteady aerodynamic problems of rotating surfaces.

FLIGHT MECHANICS PANEL

50th Panel Meeting – Symposium: **Rotorcraft Design**
16–20 May 1977, Moffett Field, California, USA

By late 1977 a whole new generation of rotorcraft will be in the advanced stages of development flying and new high-speed research craft will be in the various stages of flight test. In the past it has been customary for the military to provide the development costs necessary for the production of an economic, operational product. However, the advent of greater and more diverse civil usage of rotorcraft, with very high utilization rates, offers the military user the opportunity of gaining new experience quickly, and of reducing development costs by the procurement of off-the-shelf hardware or adaptions. To do this effectively, the military will need a better understanding of the civil market, including its criteria and requirements. This Symposium will, therefore, have two major objectives: to review the emerging technology and operational experience base and assess the potential for further technical improvements in rotorcraft, and to identify what must be done to encourage greater co-ordination of civil and military programmes, so that the cost reduction potential of such co-ordination is maximized.

The Symposium programme will consist of a Keynote Address on "Trends in Rotorcraft Design and Development", 5 Sessions and a Round Table Discussion on the "Opportunities for Co-ordinating Military and Civil Requirements and Specifications". Session I will deal with military experience and requirements and will also examine the major new rotorcraft systems under development or planned to meet these requirements. Session II will review recent civil experience and requirements for improved capabilities which have grown out of this experience. It will also report on major programmes by the manufacturers directed toward meeting these requirements. In Session III the capabilities of existing and new rotorcraft research vehicles will be examined and a report made on major programmes to investigate new rotorcraft configurations. Session IV will review the direction of major research programmes aimed at improving rotor systems, and Session V will address the differences between military and civil requirements and specifications, and will explore the potential for co-operative development of rotorcraft and the sharing of operational experience.

51st Panel Meeting – Symposium: **Fighter Aircraft Design**
3–7 October 1977, Florence, Italy (Classified)

The AGARD Multi-Panel Symposium on Fighter Aircraft Design will be led by the FMP. By the time the Symposium is held all the new strike fighters will either have entered service or be well through their development cycle. It will, therefore, be appropriate to review what has been learned from these new aircraft and compare the likely requirements of the 1980s with what technology promises. Eight sessions, each covering a particular aspect, will be presented by the Panel most appropriate to the area being covered. In the first session keynote speakers will set the theme of the meeting by making an assessment of the threat and the requirements to contain it, taking into account the potential of RPVs and the need to balance costs and complexity. The interpretation of these requirements for technology development will also be discussed. The second session will cover experience gained with the latest fighters already in service and will include aircraft armament and the pilots view of air combat. The remaining sessions will examine the various, possible applications of new technology to meet the requirements, based on recent reliable cost effectiveness experience. The subjects discussed will include system design approaches to meet the requirements, aerodynamics and configurations, propulsion, structures, avionics, guidance, and human factors. Finally, a round table discussion will explore the major issues that emerge from the meeting.

Specialists Meeting: **Performance Prediction Methods**
11–13 October 1977, Paris, France

This Specialists' Meeting will concern advances in Performance Prediction Methods and will show their practical application to modern conventional and V/STOL aircraft. Papers will describe point-performance prediction methods, integral-performance prediction methods for flight segments, airfield performance prediction methods, and methods of performance evaluation and data verification from flight tests. Following the Specialists' Meeting, the Panel will discuss the value to be gained from sponsoring the publication of an AGARDograph on Performance Prediction Methods incorporating the new techniques to be described.

GUIDANCE AND CONTROL PANEL

24th Panel Meeting – Symposium: **Applications of Advances in Navigation to Guidance and Control**
9–13 May 1977, Stuttgart, Germany

Positioning and Navigation are vital elements of Guidance and Control Systems. Within the last decade there have been significant advances in navigation techniques, making possible great improvements in guidance and control systems, and in the resulting mission performance and capabilities. The purpose of the Symposium is to promote constructive ideas and discussions on applications of advances in navigation to Guidance and Control Systems.

It can be argued that, apart from the appearance in the near future of global positioning systems, not even the existing advances in navigation have yet been fully exploited. These include advances in Inertial Navigation and advances in Radio and Radar Navigation. These will be treated in appropriate sessions of the Symposium.

In addition, there is the reasonable certainty of achieving, in the 1980's, global positioning by satellite correct to about 10 metres in three axes. This must affect the design of guidance and control systems, and there will be a session on that subject, followed by an extended discussion period.

The Symposium will also cover specific and general improvements in guidance and control capabilities related to the general theme.

25th Panel Meeting – Symposium: **Guidance and Control Design Considerations for Low-Altitude and Terminal Area Flight**
17–21 October 1977, Dayton, Ohio, USA

Future operational needs dictate that conventional and VTOL aircraft and helicopters will be operated close to the ground in a wide range of operational tasks and weather conditions. The proximity of the ground produces many common factors that apply in all such situations. In particular, these relate to the precision and modes of control of the aircraft subject to special environmental conditions near the ground, the requirements for sensing position relative to ground features and the high importance of establishing the necessary safety, integrity standards commensurate with the vulnerability to enemy defenses. It is the purpose of this Symposium to review the current state-of-the-art in actual operations and the future trends leading to cost effective solutions to these difficult problems. Sessions will address the following aspects:

- Operational problems and considerations for low-altitude flight, such as: optimization for pilot effectiveness; flight control system design for performance, safety, turbulence effects and weather conditions; display systems and requirements; ride qualities and gust alleviation needs and techniques; vulnerability to anti-aircraft systems.
- Terrain following systems problems and considerations including: design for integrity and safety; pilot display aspects for tracking and monitoring; navigation and positioning; noval design approaches.
- Weapon delivery problems and considerations including: transition from terrain following to weapon delivery mode; curved trajectory to reduce vulnerability; turbulence effects; delivery accuracy.
- Low visibility landing considerations including: operational procedures for fixed wing, helicopter and V/STOL aircraft; shortfield design considerations; effects of V/STOL techniques on low-visibility operations.
- Systems integration problems and considerations: augmentation of ground guidance systems with on-board sensors for low-visibility operations; capability to achieve low-visibility landing using on-board sensors; potentials for GPS and other navigation systems to reduce or eliminate ground guidance system for austere sites or emergencies; air traffic control at austere sites.

PROPULSION AND ENERGETICS PANEL

49th Panel Meeting – Specialists' Meetings: **A. Secondary Flows in Turbomachines. B. Power Plant Reliability**
28 March/1 April 1977, The Hague, Netherlands

This Panel Meeting will comprise two Specialists' Meetings, the first will be on Secondary Flows in Turbomachines and take two and a half days.

As further increase of the performance of turbomachines is demanding more and more sophisticated analysis of the flow in these machines, this meeting will be devoted to secondary flow phenomena such as those introduced in corners, through gaps, as well as by wall boundary-layer development and which are of increasing importance at the tip region of stator and rotor blades. Starting first with a survey on both theoretical and experimental state of research, various recent studies on secondary flows in compressors, linear cascades, and turbines will be presented. At the end, after a reflecting and resuming discussion, a Round Table Panel will draw conclusions and might recommend the direction of future work.

The following two-day meeting will be concerned with reliability of gas turbine engines. These aero propulsion systems have reached a high standard of technology and sophistication. Being rather complex they are very reliable too. But for a number of reasons like fuel saving and performance range adaptation to new missions further development of the aero gas turbine engine is required. As at the same time attention is more and more being focussed on cost effectiveness as it is on safety level, it becomes necessary to achieve:

1. high reliability at the very early stage of engine development and operation
2. long service life without prejudice to reliability at the final stage of utilization.

The success of efforts towards this end will depend on the knowledge of phenomena and the effect of actions on the reliability level. It seems to be valuable to define appropriate design, development, and testing methods.

This meeting will provide a forum for an exchange of views between civilian and military users and manufacturers from various countries. The aimed pooling of experiences might prove the starting point of definition of common guidelines to be used by engine designers.

50th Panel Meeting – Symposium: **High-Temperature Problems in Gas Turbine Engines**
19–23 September 1977, Ankara, Turkey

A major factor influencing the performance of turbojet engines is the operating temperature. Increase in operating temperature reduces fuel consumption and, at the same time, raises the thrust to weight ratio, leading to worthwhile reductions in frontal area and nacelle drag. However, high working gas temperatures pose formidable problems in terms of component life and reliability, especially for the high-pressure turbine blade where failure may occur through oxidation, thermal fatigue, corrosion or creep. Progress towards alleviating these problems is being made by the development of new materials and protective coatings, and by advances in cooling systems for both stationary and rotating components using air taken from the compressor delivery.

The purpose of this meeting is to review and highlight the main problems associated with the attainment of high temperatures in aircraft gas turbines. Attention will be focussed on methods of cooling components in the hot portion of the engine, notably the combustor and reheat liners, nozzle guide vanes and turbine components. The advantages of air cooling will also be examined alongside any penalties or compromises that may be incurred in terms of weight, cost, aerodynamic efficiency and overall engine performance. Progress in new materials and protective coatings will be discussed. Consideration will also be given to fuel and combustion problems associated with operation at high gas temperatures. Furthermore, new measuring techniques and heat transfer prediction methods will be discussed.

STRUCTURES AND MATERIALS PANEL

44th Panel Meeting – Specialists' Meeting: **(A) Unsteady Airloads in Separated and Transonic Flow, (B) Structural Aspects of Active Controls**
17–22 April 1977, Lisbon, Portugal

(A) The first session will be on the subject of "Airframe Response to Separated Flow" and will review the prediction and description of the separated flow environment and the essential effects of airframe response on individual aircraft components. These effects may lead to failures of primary or secondary structures when exceeding design stress limits, or design fatigue loads. This is of special concern for military aircraft where flight operation at extreme maneuver conditions associated with flow separation frequently occurs. The scope of study will include analytical approaches, wind-tunnel tests, as well as flight test techniques and data evaluation. Emphasis will be given to the following areas:

– Prediction of *separated flow unsteady airloads* on aeroelastically responding structures; assessments of the comparability of unsteady pressures measured on rigid and flexible structures; assessment of the practical significance of Reynolds Number effects and other similarity rules on unsteady loads due to separated flow in terms of the effects on airframe response.

- Prediction of tail vibrations induced by separated flow; assessment of flow separation from the tail, and afterbody on horizontal and vertical tail.
- Strength and fatigue design for *secondary structures* like airbrakes, spoilers, direct lift control, etc. which produce separated flow; prediction of load spectra and evaluation of the response of secondary structures.
- Definition of level of buffet and its effect on inducing fatigue failures in primary structural components of the wing.
- Prediction of the aeroacoustic environment of blown flaps, open cavities, and associated flow regimes and their effect on structural components.
- Flight test data identification of the above.
- An investigation of the present capability of the state-of-the-art to: safely predict the limitations caused by separated flow; reduce fatigue failures and maintenance costs; and improve future operational capabilities of aircraft, is of overall interest.

The second session on "Transonic Unsteady Aerodynamics for Aeroelastic Phenomena" will treat flutter, aeroservoelastic instabilities involving coupling with active control systems, and other static and dynamic aeroelastic problems, which can be dangerous flight safety phenomena and which must therefore be predicted with accuracy and prevented. Margins of safety are least in the transonic speed range which is consequently the most critical speed regime. However, no dependable theoretical methods are yet available for predicting unsteady transonic airloads on lifting surfaces and control surfaces. Accurate prediction of the latter becomes more important for active control systems used in load alleviation, flutter suppression and ride control. Measurement of unsteady airloads on models can be performed but are expensive for routine applications. Some noticeable progress is being made in the development of two-dimensional theory and in the measurement of unsteady aerodynamic pressures in Europe and more recently in the US. Also some three-dimensional methods are being explored. A timely exchange of the latest information would point out most promising methods, delineate gaps and opportunities, accelerate mutual progress, and define common configurations and conditions for experimental tests and for comparing and evaluating various methods developed. Perhaps empirical methods based on test results and theory can be suggested which will predict transonic aeroelastic phenomena and define optimum structural characteristics with improved accuracy. In addition to improving analytical confidence, a dependable approach could reduce the cost of aeroelastic model and flight flutter tests. This meeting will be coordinated with *FDP* and joint participation on programs of mutual interest will be strongly recommended.

(B) The theme of this meeting will deal with the philosophy and approach on the use of active control to realize structural improvements. The question of what constitutes a good balance of effort to achieve a successful active contro system will be examined. Specifically dealt with will be the techniques for evaluating the system transfer function, with the relative roles of ground vibration testing, bench testing of component parts, and the merits of open and closed loop testing being examined. The question of what constitutes an appropriate index of performance will be of central significance. Preparation of this Meeting will be coordinated with FMP.

45th Panel Meeting – Specialists' Meeting: **Non-Destructive Inspection (NDI) Relationships to Aircraft Design and Materials**
25–30 September 1977, Geilo, Norway

The objectives of the meeting are:

1. To establish which information obtainable through the various NDI methods is relevant when applied to the control of defects present in metallic and composite structures or mechanical components, either dismantled or in aircraft service.
2. To establish the relationships among materials suppliers, NDI experts, design engineers between:
   (a) the various kinds and density of defects generated in the course of manufacturing and fabrication,
   (b) the various kinds and density of defects detectable by the NDI techniques, their sensitivity, precision and powers of resolution,
   (c) the relevance of above information for the needs of design engineers.
3. To point out needs, limits of validity and reliability of the various NDI methods which are used and the necessity of developing new ones to obtain more detailed and/or pertinent information, mainly in the case of new materials and composites.
4. To evaluate the incidence of costs on NDI controls during manufacturing and maintenance as a function of the relevance of the information obtained.

TECHNICAL INFORMATION PANEL

30th Panel Meeting – Specialists' Meeting: **The Impact of Future Developments in Communications, Information Technology and National Policies on the Work of the Aerospace Information Specialist**
22–24 June 1977, Lysebu, Norway

The rapid development of new communication techniques, combined with greatly reduced unit costs of communication hardware, has led to easier access to more information for larger segments of the population. In the area of aerospace scientific and technical information, this development should provide greater opportunities for making systematic use of mankind's aggregated experience and knowledge, collected and stored over time. However, good use can only be made of these opportunities if preparations are begun now.

The role of the information specialist is undoubtedly changing with the advent of these developments, and it may also be desirable for him to influence their future course. The theme of this Meeting is to identify the main trends in communications and information technology, to assess their impact on the information specialist, and to consider what other developments might be desirable, particularly in relation to aerospace scientific and technical information. To this end, it is proposed to bring together those in the forefront of these technologies and the information specialists who will have to make use of them, or provide complementary services, in order that each may benefit from the other's knowledge and experience.

A number of papers will also be given outlining national plans for the future of their Scientific and Technical Information activities.

LECTURE SERIES

Lecture Series 86: **Computational Fluid Dynamics** (with the von Kármán Institute and Fluid Dynamics Panel)
21–23 March 1977, von Kármán Institute, Belgium
25–27 April 1977, Wright-Patterson Air Force Base, Dayton, Ohio, USA

This Lecture Series is devoted to recent developments in numerical methods to solve complex problems in fluid dynamics with high-speed computers.

It is proposed that the following topics should be treated in detail:

- the foundations and development of the finite-element method to solve the partial differential equations of inviscid and viscous fluid mechanics. Various applications in different speed regimes will be considered.
- numerical turbulence modelling. Recent developments will be presented with the aim of assessing the state-of-the-art.
- flow representation, including separated regions, with numerical methods using discrete vortices.
- fast numerical methods to solve steady-state inviscid and viscous problems in fluid dynamics.

Lecture Series Director: Professor H.J.Wirz, von Kármán Institute, Belgium.

Lecture Series 87: **Microprocessors and Their Applications** (with Avionics Panel)
14–15 April 1977, Griffiss Air Force Base, USA
18–19 April 1977, London, UK
21–22 April 1977, Munich, Germany

The microprocessor (miniaturized processor) has recently become a viable proposition and promises a revolution in system design, flexibility, volume and cost in the data and signal processing areas of all types of avionics systems.

Microprocessor hardware available on the market is rapidly evolving with the employment of alternative technologies such as Silicone Oxide Semi-conductor and Schottky Bipolar to enable operation at clock rates orders higher than the early capability. In addition, manufacturers are developing realistic hardware to enable rapid vectored interrupt handling which is often necessary in real-time applications. As usual, hardware is running ahead of software and although most applications are currently written in symbolic assembler code, there is increasing awareness of the advantages of efficient high-level compilers and effort is now being expended on the implementation of such languages.

One of the problems with microprocessors is the necessity to design both hardware and software configurations for a particular problem, a task more appropriate to a computer systems designer rather than to one versed in avionics. In two years time, the potentialities of the microprocessor will be fully established and that would seem to be the appropriate point at which to present the new technology to a wider Avionics audience in an AGARD Lecture Series. The following topics will be covered:

- Programming languages and basic programming techniques,
- Microcomputer design and future trends in microcomputer components,
- Motorola's microcomputer families and advanced plans,
- Microprocessor support software,
- Interaction between LSI process technology and the design of microprocessor systems,
- A microcomputer based process control computer,
- The M68 in a practical system environment,
- A civil aviation microprocessor application – The delayed flap approach,
- Using a microprocessor as a computer interface controller,
- Interaction between microprocessors and custom LSI.

Lecture Series Director: Mr R.C.Sloan, EMI Electronics Ltd, Hayes, United Kingdom.

Lecture Series 88: **Applications of Remote Sensing to Ocean Surveillance** (with Electromagnetic Wave Propagation Panel)
3–4 October 1977, Oslo, Norway
6–7 October 1977, The Hague, Netherlands
11–12 October 1977, Rome, Italy

The sea covers more than three quarters of the earth and the concealment it provides to military forces will make it the area of major activities in the next decade. The defence of land and sea is vital to the NATO alliance. Land surveillance has been covered in several AGARD meetings while the oceans thus far have received little attention. Techniques for ocean surveillance from satellites and aircraft reached a high degree of sophistication as the result of the combined efforts in space and military programs. The limitations of these techniques come not so much from technology itself but rather from the propagation medium, air and sea. These techniques and the interpretation of results are totally different for land and sea.

This lecture series will therefore present the mathematical tools and their applications to the problems of resolving, recognizing and identifying targets and sources of activities in the ocean. This series should be of interest to physicists and engineers who want to learn the mathematical methods applicable to ocean surveillance, to military users who want to interpret results and infer tactical and strategic implications and to industries interested in developing future generation hardware.

The lecture topics cover two broad categories of surveillance:

- Ocean targets, for instance ships (Imaging),
- Ocean phenomena indicative of military activities, for instance changes in biology or surface temperatures (Radiometry).

The lectures will cover eight topics:

1. Operational requirements and problems: problems, needs, priorities.
2. Radiation and environmental physics refresher: processes, sources, noise, parameters and units, atmospheric and oceanographic phenomena.
3. Microwave scanning radiometry.
4. Infrared and visible radiometry and imaging systems.
5. Radar imaging systems.
6. Electric and magnetic sensing systems.
7. Systems applications and problems panel: overview of existing systems and audience interactive discussion.
8. Concluding remarks: recap of military needs and scientific and engineering highlights. Problems and issues and future direction.

A Round Table Discussion will conclude the presentations.

Lecture Series Director: Dr W.Keeler, Naval Material Command, Washington, USA.

Lecture Series 89: **Task Oriented Flight Control Systems** (with Guidance and Control Panel)
6–7 June 1977, Bolkesjø, Norway
9–10 June 1977, London, UK
14–15 June 1977, Dayton, Ohio, USA

The use of electrical control paths in the flight control systems of manned aircraft has now become established practice for a wide range of aircraft types. Recent developments in data processing are establishing the viability of high integrity, high authority full-time electrical control systems. This in turn offers the possibility of designing the control systems characteristics to match particular operational tasks, and of varying the control characteristics during or between flights according to operational needs. At the same time it becomes possible to blend together the control of additional degrees of freedom such as may be provided by direct lift and direct side-force generators.

The aim of this Lecture Series is to discuss the benefits, problems, design and engineering aspects of these new developments. It will commence with a broad review of the state-of-the-art in modern flight control theory and practice, discuss the new concepts of task-oriented control systems, and review some recent relevant simulator and flight trials. It will conclude with a Round Table Discussion during which an exchange of view between speakers and participants will be encouraged.

The following topics will be covered:

1. Introduction and Overview.
2. Control law design techniques. Basic control law theory, stability criteria for low-order and high-order systems. Frequency response, root locus and transient response techniques. Optimization procedures, digital control law theory.
3. Pilot control system interaction, handling qualities criteria, pilot models, simulation and flight test techniques. Stick feel characteristics. Crew workload implications.
4. Engineering of control systems and implications on control law design. Sensors, processors and actuators, structural and aerodynamic interactions.
5. The need for task-oriented control laws. Examples of operational tasks, and basic requirements in terms of total aircraft system performance. Effect of weapon characteristics in weapon aiming tasks.
6. Implementation of task-oriented control laws. Design aspects. Coupling of degrees of freedom. Compromises between design criteria. Effects of external disturbances. Sensor and processor implications.
7. Additional degrees of freedom. Aerodynamic and structural aspects of providing direct lift, direct sideforce. Control systems design. Piloting problems and ways of blending to reduce workload.
8. Display and crew station implications. Arranging displays to be compatible with the control laws. Mode selection and verification techniques. Integration of navigation and guidance information. Miniature control sticks.
9. Current programmes. Each speaker will give a brief account of relevant simulator and flight test work in his own country. Areas to be stressed are correlation between predicted and test results, limitations and potential pitfalls.

Lecture Series Director: Dr G.Hunt, Royal Aircraft Establishment, Farnborough, Hampshire, UK.

Lecture Series 90: **Laser Optical Measurement Methods for Aero Engine Research and Development** (with Propulsion and Energetics Panel)
25–26 August 1977, Trenton, New Jersey, USA
30–31 August 1977, London, UK
5–6 September 1977, Urbino, Italy

In recent years many optical measuring methods, most using lasers, for determining flow velocity (with turbulence and fluctuations), temperature, and species concentration have been studied. The main advantage is that the flow is not disturbed. They are of great value for research and development on engines and components and for the understanding of fundamental flow processes.

This Lecture Series will inform propulsion specialists of the techniques that are currently available, how to use them and their limitations. It will review experience to date in practical applications. Laser-velocimetry will be emphasized since it is the only technique which has achieved practical importance up until now. Raman-scattering and holography interferometry will also be addressed. Commonly-used techniques and qualitative type methods such as infrared for surface temperature and Schlieren techniques will not be addressed.

The lectures will consist of:

- Introduction on requirements (quantities to be measured, boundary conditions, needed techniques);
- Laser-doppler and laser-two-focus velocimetry (fundamentals, analysis of errors, limits, practical use, design details, equipment and data processing);
- Special problems of laser velocimetry (highly fluctuating, separated and recirculating flows, application to flames, combustor and reheat systems);
- Review of other optical techniques (Laser-Raman scattering, holography, interferometry, basic principles, status of development and applicability for engine components).

Lecture Series Director: Dr.-Ing. H.B.Weyer, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt EV, Cologne, Germany.

Lecture Series 91: **Advanced Manufacturing Techniques in Joining of Aerospace Materials** (with Structures and Materials Panel)
17–18 October 1977, London, UK
20–21 October 1977, Germany
24–25 October 1977, Lyngby, Denmark

Advanced aerospace structures depend to a large extent on new joining techniques. The highest possible material strength-to-weight ratio is an important requirement. Advanced light materials such as titanium alloys or plastic matrix composites are answers, as well as improved welding and adhesive bonding processes. Often the selection of the optimum joining technology is the prior condition for success in introducing advanced structural components in the aircraft industry. This Lecture Series will present improved or new cost-effective welding methods for joints of high integrity and with properties close to those of the parent metal. Progress in joining composites will be discussed, based on modern design principles.

Lecture Series Director: Professor Dr.-Ing. H.D.Steffens, University of Dortmund, Germany.

MILITARY COMMITTEE STUDIES

13th Meeting of **Aerospace Applications Studies Committee**
2–11 May 1977, The Hague, Netherlands

The Committee will receive the final report on Study No.11 on "Suppression of Detection and Guidance Systems, Other than Radar, Associated with SAMs, ASMs and Guided Bombs", refine terms of reference for Study No.12, organize a new Working Group for Study No.12, and define terms of reference for Study No.13.

14th Meeting of **Aerospace Applications Studies Committee**
7–17 November 1977, Paris, France

The Committee will conduct a mid-term review of Study No.12 refine terms of reference for Study No.13, and organize a new Working Group for Study No.13.

SECTION II

1976 AGARD PUBLICATIONS

- 1976 AGARD PUBLICATIONS BY SERIES
- ABSTRACTS OF 1976 AGARD PUBLICATIONS BY PANEL OR ACTIVITY

ABBREVIATIONS

ASMP	AEROSPACE MEDICAL PANEL
AVP	AVIONICS PANEL
EPP	ELECTROMAGNETIC WAVE PROPAGATION PANEL
FMP	FLIGHT MECHANICS PANEL
FDP	FLUID DYNAMICS PANEL
GCP	GUIDANCE AND CONTROL PANEL
PEP	PROPULSION AND ENERGETICS PANEL
SMP	STRUCTURES AND MATERIALS PANEL
TIP	TECHNICAL INFORMATION PANEL
MCS	MILITARY COMMITTEE STUDIES
LS	LECTURE SERIES

1976 AGARD PUBLICATIONS BY SERIES

ADVISORY REPORTS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AR84	BIOPHYSICAL PROBLEMS IN AEROSPACE MEDICINE, PROBLEMES BIOPHYSIQUES PARTICULIERS DE LA MEDECINE AEROSPATIALE	December	ASMP
AR88 Volume I	USE OF PRECISION POSITIONING SYSTEMS BY NATO Aerospace Applications Study No.6 (Classified)	July	MCS
AR92	CURRENT STANDARDS OF FATIGUE TEST ON STRIKE AIRCRAFT R.D.J.Maxwell	January	SMP
AR93	FUTURE FUELS FOR AVIATION I.Irving Pinkel	January	PEP
AR94	TECHNICAL EVALUATION REPORT ON THE PEP WORKING GROUP NO.4 ON IMPROVED NOZZLE TESTING TECHNIQUES IN TRANSONIC FLOW F.Jaarsma	February	PEP
AR96	TECHNICAL EVALUATION REPORT OF AGARD SPECIALISTS MEETING ON WING-WITH-STORES FLUTTER W.J.Mykytow	February	SMP
AR97	TECHNICAL EVALUATION REPORT ON WIND-TUNNEL DESIGN AND TESTING TECHNIQUES H.Goethert	August	FDP
AR98	TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON FLOW SEPARATION D.J.Peake and W.J.Rainbird	October	FDP
AR99	SUMMARY OF THE DISCUSSIONS ON STRUCTURAL DESIGN TECHNOLOGY R.B.Baird	December	SMP

REPORTS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
R636	COMMENTS ON TRANSONIC AND WING-STORE UNSTEADY AERODYNAMICS H.Tijdeman and R.Destuynder	January	SMP
R637	COMPARAISON DES FONCTIONS DE TRANSFERT CALCULEES ET MESUREES SUR L'AVION CONCORDE J.Roustan	January	SMP
R638	FATIGUE IN COMPOSITE MATERIALS K.L.Reifsnider	February	SMP
R639	DESIGN OF STRUCTURES IN COMPOSITE MATERIALS (Basic Data and Interdisciplinary Action) I.C.Taig, A.August, R.Hadcock and S.Dastin	January	SMP
R640	THE DEVELOPMENT OF FATIGUE/CRACK GROWTH ANALYSIS LOADING SPECTRA J.E.Holpp and M.A.Landy	January	SMP
R641	REVIEW OF ADVANCED POWDER METALLURGICAL FABRICATION TECHNIQUES IN EUROPEAN NATO COUNTRIES P.W.Sutcliffe	June	SMP

REPORTS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
R642	FOURTH ADVANCED OPERATIONAL AVIATION MEDICINE COURSE; ROYAL AIR FORCE INSTITUTE OF AVIATION MEDICINE, FARNBOROUGH, HAMPSHIRE, 17–26 JUNE 1975 A.N.Nicholson (Editor)	May	ASMP
R642 (Suppl.)	FOURTH ADVANCED OPERATIONAL AVIATION MEDICINE COURSE (Classified) J.Ernsting and A.N.Nicholson (Editors)	June	ASMP
R643	A COMPARISON OF METHODS USED IN INTERFERING LIFTING SURFACE THEORY W.P.Rodden	February	SMP
R644	ON THE FLOW QUALITY NECESSARY FOR THE LARGE EUROPEAN HIGH-REYNOLDS-NUMBER TRANSONIC WINDTUNNEL LEHRT J.P.Hartzuiker, P.G.Pugh, W.Lorenz-Meyer and G.E.Fasso. D.Küchemann (Editor)	March	FDP
R645	UNSTEADY AERODYNAMICS	March	SMP
R646	STRUCTURAL IDENTIFICATION ON THE GROUND AND IN FLIGHT INCLUDING COMMAND AND STABILITY AUGMENTATION SYSTEM INTERACTION	June	SMP
R647	UNSTEADY PRESSURES DUE TO CONTROL SURFACE ROTATION AT LOW SUPERSONIC SPEEDS – Comparison between Theory and Experiment C.G.Lodge and H.Schmid	September	SMP
R648	ADVANCES IN ENGINE BURST CONTAINMENT AND FINITE ELEMENT APPLICATIONS TO BATTLE-DAMAGED STRUCTURE	September	SMP
R649	METHODOLOGY OF LARGE DYNAMIC FILES A.K.Gillis	December	TIP
R650	STATE-OF-THE-ART IN UNSTEADY AERODYNAMICS W.P.Rodden	November	SMP
R651	MECHANICAL PROPERTIES OF CERAMICS FOR HIGH TEMPERATURE APPLICATIONS	December	SMP
R652	NON-LINEAR EFFECTS IN AIRCRAFT GROUND AND FLIGHT VIBRATION TESTS G.Haidl	December	SMP

AGARDOGRAPHS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AG160 Volume 7	STRAIN GAUGE MEASUREMENTS ON AIRCRAFT E.Kottkamp, H.Wilhelm and D.Kohl	April	FMP
AG215	FLUIDICS TECHNOLOGY J.M.Kirshner (Editor)	January	GCP
AG216	OCR AND ITS APPLICATION TO DOCUMENTATION – A state of the art review. D.A.Bush and J.A.Weaver	March	TIP
AG219	RANGE INSTRUMENTATION, WEAPONS SYSTEMS TESTING AND RELATED TECHNIQUES	February	GCP

AGARDOGRAPHS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AG219 (Suppl.)	RANGE INSTRUMENTATION, WEAPONS SYSTEMS TESTING AND RELATED TECHNIQUES (Classified)	March	GCP
AG221	ADVANCED TECHNIQUES IN CRASH IMPACT PROTECTION AND EMERGENCY EGRESS FROM AIR TRANSPORT AIRCRAFT R.G.Snyder	June	ASMP
AG222	FLOW OF SOLID PARTICLES IN GASES G.Rudinger	October	FDP

CONFERENCE PROCEEDINGS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
CP168 (Suppl.)	FLOW SEPARATION (one paper) L.Crocco	February	FDP
CP173	RADIO SYSTEMS AND THE IONOSPHERE	January	EPP
CP174	WINDTUNNEL DESIGN AND TESTING TECHNIQUES	March	FDP
CP176	MEDIUM ACCURACY LOW COST NAVIGATION	August	AVP
CP177	UNSTEADY PHENOMENA IN TURBOMACHINERY	April	PEP
CP179	THE PROBLEM OF OPTIMIZATION OF USER BENEFIT IN SCIENTIFIC AND TECHNOLOGICAL INFORMATION TRANSFER	March	TIP
CP180	THE ROLE OF THE CLINICAL LABORATORY IN AEROSPACE MEDICINE R.G.Troxler (Editor)	May	ASMP
CP181	HIGHER MENTAL FUNCTIONING IN OPERATIONAL ENVIRONMENTS B.O.Hartman (Editor)	April	ASMP
CP182	THE USE OF IN-FLIGHT EVALUATION FOR THE ASSESSMENT OF AIRCREW FITNESS C.L.Ward (Editor)	February	ASMP
CP183	OPTICAL PROPAGATION IN THE ATMOSPHERE	May	EPP
CP185	ALLOY DESIGN FOR FATIGUE AND FRACTURE RESISTANCE	January	SMP
CP186	IMPACT DAMAGE TOLERANCE OF STRUCTURES	January	SMP
CP187	FLIGHT/GROUND TESTING FACILITIES CORRELATION	April	FMP
CP188	PLANS AND DEVELOPMENTS FOR AIR TRAFFIC CONTROL SYSTEMS A.Benoit and D.R.Israel (Editors)	February	GCP
CPP189	THE PATHOPHYSIOLOGY OF HIGH SUSTAINED $+G_z$ ACCELERATION, LIMITATION TO AIR COMBAT MANOEUVERING AND THE USE OF CENTRIFUGES IN PERFORMANCE TRAINING (Preprints)	March	ASMP
CP189	THE PATHOPHYSIOLOGY OF HIGH SUSTAINED $+G_z$ ACCELERATION, LIMITATION TO AIR COMBAT MANOEUVERING AND THE USE OF CENTRIFUGES IN PERFORMANCE TRAINING N.P.Clarke and S.D.Leverett (Editors)	October	ASMP
CPP190	RECENT EXPERIENCE/ADVANCES IN AVIATION PATHOLOGY (Preprints)	March	ASMP

CONFERENCE PROCEEDINGS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
CP190	RECENT EXPERIENCES/ADVANCES IN AVIATION PATHOLOGY	December	ASMP
CPP191	VISUAL AIDS AND EYE PROTECTION FOR THE AVIATOR (Preprints)	March	ASMP
CP191	VISUAL AIDS AND EYE PROTECTION FOR THE AVIATOR T.J.Tredici (Editor)	October	ASMP
CPP192	ARTIFICIAL MODIFICATION OF PROPAGATION MEDIA (Preprints)	March	EPP
CPP193	APPLICATIONS OF NON-INTRUSIVE INSTRUMENTATION IN FLUID FLOW RESEARCH (Preprints)	April	FDP
CP193	APPLICATIONS OF NON-INTRUSIVE INSTRUMENTATION IN FLUID FLOW RESEARCH	September	FDP
CPP194	SMALL SOLID PROPELLANT ROCKETS FOR FIELD USE (Preprints)	April	PEP
CP194	SMALL SOLID PROPELLANT ROCKETS FOR FIELD USE	September	PEP
CP194 (Suppl.)	SMALL SOLID PROPELLANT ROCKETS FOR FIELD USE (Classified)	October	PEP
CPP195	THROUGH-FLOW CALCULATIONS IN AXIAL TURBOMACHINERY (Preprints)	April	PEP
CP195	THROUGH-FLOW CALCULATIONS IN AXIAL TURBOMACHINERY	October	PEP
CPP196	AVIONIC COOLING AND POWER SUPPLIES FOR ADVANCED AIRCRAFT (Preprints)	May	AVP
CP196	AVIONIC COOLING AND POWER SUPPLIES FOR ADVANCED AIRCRAFT	November	AVP
CPP197	NEW DEVICES, TECHNIQUES AND SYSTEMS IN RADAR (Preprints)	May	AVP
CP198	FLIGHT SIMULATION/GUIDANCE SYSTEMS SIMULATION	June	FMP/GCP
CP199	STALL/SPIN PROBLEMS OF MILITARY AIRCRAFT	June	FMP
CP200	ADVANCED FABRICATION TECHNIQUES IN POWDER METALLURGY AND THEIR ECONOMIC IMPLICATIONS	November	SMP
CPP201	VISUAL PRESENTATION OF COCKPIT INFORMATION INCLUDING SPECIAL DEVICES USED FOR PARTICULAR CONDITIONS OF FLYING (Preprints)	August	ASMP
CP201	VISUAL PRESENTATION OF COCKPIT INFORMATION INCLUDING SPECIAL DEVICES USED FOR PARTICULAR CONDITIONS OF FLYING	November	ASMP
CPP202	SPECIAL ASPECTS OF AVIATION OCCUPATIONAL AND ENVIRONMENTAL MEDICINE (Preprints)	August	ASMP
CPP203	RECENT ADVANCES IN SPACE MEDICINE (Preprints)	August	ASMP

CONFERENCE PROCEEDINGS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
CPP204	PREDICTION OF AERODYNAMIC LOADING (Preprints)	August	FDP
CPP205	VARIABLE GEOMETRY AND MULTICYCLE ENGINES (Preprints)	August	PEP
CP206	HELICOPTER DESIGN MISSION LOAD SPECTRA	August	SMP
CPP207	ADVANCEMENTS IN RETRIEVAL TECHNOLOGY AS RELATED TO INFORMATION SYSTEMS (Preprints)	September	TIP
CP207	ADVANCEMENTS IN RETRIEVAL TECHNOLOGY AS RELATED TO INFORMATION SYSTEMS	December	TIP
CPP208	EM PROPAGATION CHARACTERISTICS OF SURFACE MATERIALS AND INTERFACE ASPECTS (Preprints)	October	EPP
CPP209	PROPAGATION LIMITATIONS OF NAVIGATION AND POSITIONING SYSTEMS (Preprints)	October	EPP
CP210	NUMERICAL METHODS AND WINDTUNNEL TESTING	October	FDP
CP211	NIGHT AND ALL-WEATHER GUIDANCE AND CONTROL SYSTEMS FOR FIXED-WING AIRCRAFT (Classified)	November	GCP

LECTURE SERIES

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
LS81	AVIONICS DESIGN FOR RELIABILITY	March	DPP
LS82	PRACTICAL ASPECTS OF KALMAN FILTERING IMPLEMENTATION	March	DPP
LS83	MODERN PREDICTION METHODS FOR TURBOMACHINERY PERFORMANCE	June	DPP
LS84	THE THEORY, SIGNIFICANCE AND PREVENTION OF CORROSION IN AIRCRAFT	September	DPP
LS85	REVIEW OF DEVELOPMENTS IN COMPUTER OUTPUT MICROFILM (COM) AND MICROGRAPHIC TECHNOLOGY, PRESENT AND FUTURE	September	DPP
LSP80	AERODYNAMIC NOISE (Preprint)	November	DPP

MISCELLANEOUS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AGARD BULLETIN 76/1: MEETINGS, PUBLICATIONS, MEMBERSHIP		January	HQ
ELEVENTH AGARD ANNUAL MEETING		February	HQ
AGARD HISTORY 1952–1975		February	HQ
DIRECTOR'S ANNUAL REPORT TO THE NORTH ATLANTIC MILITARY COMMITTEE 1975		March	HQ
AGARD HIGHLIGHTS 76/1		March	HQ

MISCELLANEOUS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
	TECHNICAL PRESENTATIONS ON SCIENTIFIC AND TECHNOLOGICAL FORECASTING	June	HQ
	AGARD BULLETIN 76/2: TECHNICAL PROGRAM 1977	July	HQ
	AGARD HIGHLIGHTS 76/2	September	HQ

ABSTRACTS OF 1976 AGARD PUBLICATIONS BY PANEL OR ACTIVITY

AEROSPACE MEDICAL PANEL (ASMP)

Conference Proceedings 182
C.L.Ward (Editor)
February 1976
72 pages
ISBN 92-835-1208-1

The Use of In-Flight Evaluation for the Assessment of Aircrew Fitness

The proceedings reprint the seven papers delivered at the ASMP Specialists' Meeting, Ankara, Turkey, October 1975, and include a general discussion and a Technical Evaluation Report. The importance of in-flight assessment cannot be emphasized too greatly inasmuch as in-flight performance and pathophysiological status and events are the ultimate determinants of fitness to perform safely and effectively in the aerial environment. This is particularly true because such evaluations are frequently the last opportunity to preserve experienced aircrew whose contributions would be forfeited by a less comprehensive and finally definitive analysis of integrated ability.

Many aspects of in-flight determination of physical, psychological, physiological and bio-aeronautical suitability and fitness of aircrew were considered. These included some inflight and simulation techniques, examination methods, bioinstrumentation and procedures for fitness studies as well as results of assessment of the ability to fly safely with orthopedic injuries, amputations, and visual deficiencies, plus a few other physiological and psychological situations. Also included are assessments of paratroopers and non-pilot aircrew in their performance of duty.

Conference Preprint 189
March 1976
54 pages

The Pathophysiology and High Sustained $+G_z$ Acceleration, Limitation to Air Combat Manoeuvering and the Use of Centrifuges in Performance Training

See Conference Proceedings 189 below.

Conference Preprint 190
March 1976
94 pages

Recent Experience/Advances in Aviation Pathology

See Conference Proceedings 190 below.

Conference Preprint 191
March 1976
72 Pages

Visual Aids and Eye Protection for the Aviator

See Conference Proceedings 191 below.

Conference Proceedings 181
B.O.Harman (Editor)
April 1976
88 pages
ISBN 92-835-1216-2

Higher Mental Functioning in Operational Environments

This ASMP Specialists' Meeting held at Ankara, Turkey, October 1975 was divided into two half day sessions, one on current studies and the other on required methodology and present deficiencies. 11 papers were presented. There is a general agreement among military behavioural scientists that operational stress affects higher mental functions more than the simpler levels of perceptual-motor behaviour. A number of piloting as well as non-piloting jobs are vulnerable to this source of performance impairment. In general, few laboratories are studying behaviour at this more complex level.

Conference Proceedings 180
R.G.Troxler (Editor)
May 1976
144 pages
ISBN 92-835-0165-9

The Role of the Clinical Laboratory in Aerospace Medicine

The clinical laboratory is indispensable in the practice of aerospace medicine. The optimal tests, techniques and procedures, along with their clinical correlations for judicious application are matters of continuing research and development. The AGARD ASMP Specialists' Meeting held in Ankara, Turkey, October 1975, was directed towards improving diagnostic accuracy, enhancing utilization of diagnostic resources, and providing increased impetus toward standardization of clinical laboratory methods in aerospace medicine in the international community.

Papers were included on the following topics: Investigations on chemical, physical, physiological, radiographic and electrical test techniques, methodologies and applications in aerospace medicine; Research, development and evaluation of pertinent tests, techniques and procedures in aerospace medicine; Results of clinical and epidemiological application of these tests, techniques and procedures; Limitations of the tests, techniques and procedures due to variability, interference and inadequacies.

Report 642
A.N.Nicholson (Editor)
May 1976
124 pages
ISBN 92-835-1217-0

Fourth Advanced Operational Aviation Medicine Course; Royal Air Force Institute of Aviation Medicine, Farnborough, Hampshire, 17–26 June 1975

During June 1975 the Fourth Advanced Operational Aviation Medicine Course was held at the Royal Air Force Institute of Aviation Medicine, Farnborough. Representatives from nine NATO countries attended the course, and they included doctors from sea, land and air forces.

The course covered in depth some aspects of aviation medicine which are of current concern to the effectiveness of NATO air forces. The topics included the training of aircrew in aviation medicine, medical aspects of naval helicopter operations on the northern flank of NATO, developments in personal equipment with special reference to helmet developments, high speed escape and thermal problems, and the use of hypnotics in air operations. This publication includes lectures delivered to the Course.

Report 642 (Supplement)
J.Ernsting and A.N.Nicholson (Editors)
June 1976
72 pages

Fourth Advanced Operational Aviation Medicine Course
This Supplement to Report 642 contains lectures given in the classified session.

AGARDograph 221
R.G.Snyder
June 1976
320 pages
ISBN 92-835-1218-9

Advanced Techniques in Crash Impact Protection and Emergency Egress from Air Transport Aircraft
Analysis of all NATO member air transport accidents, 1964–1975, revealed that injuries and fatalities, when such information could be determined, were primarily due to the post-crash effects of fire, smoke and toxic fumes, and secondarily to crash impact. Future air transport design trends were reviewed, and approximately 150 advanced crash-impact and emergency-egress concepts, devices, and state-of-the-art techniques were evaluated. It was concluded that rear-facing passenger seats, the NASA Ames ($21+G_x$ $45+G_z$) airline seat, and the production Sheidahl smoke hood can provide significantly improved occupant protection, while high-energy emergency egress systems appear promising for future aircraft.

Conference Preprints 201
August 1976
64 pages

Visual Presentation of Cockpit Information including Special Devices used for Particular Conditions of Flying
See Conference Proceedings 201 below.

Conference Preprint 202
August 1976
72 pages

Special Aspects of Aviation Occupational and Environmental Medicine
Preprints of papers delivered at Specialists' Meeting, Athens, September 1976.

Conference Preprint 203
August 1976
94 pages

Recent Advances in Space Medicine
Preprints of papers delivered at Specialists' Meeting, Athens, September 1976.

Conference Proceedings 189
N.P.Clarke and S.D.Leverett (Editors)
October 1976
80 pages
ISBN 92-835-1227-8

The Pathophysiology of High Sustained $+G_z$ Acceleration, Limitation to Air Combat Manoeuvering and the Use of Centrifuges in Performance Training
High levels of air combat manoeuvering acceleration, achievable for sustained periods in new fighters tax the physical and physiologic limits of the aircrew. Single or intermittent exposures are considered an acceptable risk. No cumulative effects are recognized but research is incomplete on this point. High G centrifuge training is recommended. The tilt-back seat provides optimum physiologic protection. Papers were presented at the ASMP Specialists' Meeting held in Copenhagen, April 1976.

Conference Proceedings 191
T.J.Tredici (Editor)
October 1976
92 pages
ISBN 92-835-0177-2

Visual Aids and Eye Protection for the Aviator
Discussed during this conference are both the established, proven methods of eye protection and visual enhancement and newer, just emerging modalities, products of recent space age technology. Presentations are made on USAF aviator's sunglasses, lenses for correction of presbyopia, and contact lens use by the aviator. Also discussed are the newly developed helmet-mounted sights and display systems, as well as recent innovations in ceramics (PLZT) that show great promise in solving the retinal burn/flashblindness problem. Other areas of discussion encompass such physiologic extenders as the AN/PVS-5 night vision goggles and hand-held optically stabilized target acquisition devices. With these devices, man's most important sense – VISION – needed for flying is being extended, amplified, and enhanced in an attempt to bring his physiologic capabilities on par with the performance capabilities of modern aircraft. Papers presented at the Aerospace Medical Panel Specialists' Meeting held in Copenhagen, April 1976.

Conference Proceedings 201
G.Perdriel (Editor)
November 1976
90 pages
ISBN 92-835-0181-0

Visual Presentation of Cockpit Information including Special Devices used for Particular Conditions of Flying
These Proceedings of the ASMP Specialists' Meeting held in Athens, Greece, September 1976, include nine papers on: Development of Aircraft Instruments; Criti ue de l'Eclairage des Postes de Pilotage; Comparative Experimental Evaluation

of Two-Dimensional and Pseudo-Perspective Displays; The Malcolm Horizon; Ground-Referenced Visual Orientation with Imaging Displays; Terrain Following using Stereo Television; Presentation of Cartographic Information in Projected Map Displays; Matrix Element Display Devices; and a Theoretical Framework to Study the Effect of Cockpit Information. An introduction and conclusion are contributed by the editor.

Advisory Report 84
December 1976
174 pages
ISBN 92-835-0168-3

Biophysical Problems in Aerospace Medicine – Problèmes Biophysiques Particuliers de la Médecine Aérospatiale

This publication contains papers prepared by an Aerospace Medical Panel Working Group. The five papers are as follows: Cosmic Radiation Doses at Aircraft Altitudes; Biological Studies of Cosmic Rays; Radiobiclogical Problems of High Altitude Flights; Non-Ionising Electromagnetic Fields, Environmental Factors in Relation to Military Personnel; and Medical Aspects of Lasers and Laser Safety Problems.

Les cinq communications constituant la présente publication on été préparées par un Groupe de Travail du Panel de la Médecine Aérospatiale de l'AGARD. Les titres des communications sont respectivement: Doses dues aux Rayonnements Cosmiques aux Altitudes Inférieures à 25 km; Etudes Biologiques des Rayonnements Cosmiques; Problèmes Radiobiologiques Posés par les Vols à Haute Altitude (Inférieure à 25 km); Les Champs Electromagnetiques Non-Ionisants. Facteurs d'Environnement en Milieu Militaire; et Les Lasers – Aspects Médicaux et Problèmes de Sécurité.

Conference Proceedings 190
December 1976
160 pages
ISBN 92-835-0184-5

Recent Experience/Advances in Aviation Pathology

This volume contains the papers, discussions and a Technical Evaluation Report of the ASMP Specialists' Meeting held in Copenhagen, Denmark, 5–9 April 1976. Three papers describe the organization and early development of aviation pathology and its applications to aircraft-accident investigation in the United States, Germany, and France. These are followed by presentations on legal problems, including the international aspects of determination of jurisdiction to investigate aircraft accidents and to perform special procedures such as screening techniques in identification, correlation of biorhythmic criticality, and roentgenographic evaluation that have generated significant interest among investigators in recent years. Interpretation of toxicologic analyses, the significance of specific injuries, and investigation of accidents involving specialized types of aircraft such as helicopters and agricultural aircraft were also discussed.

AVIONICS PANEL (AVP)

Conference Preprint 196
May 1976
120 pages

Avionic Cooling and Power Supplies for Advanced Aircraft

See Conference Proceedings 196 below.

Conference Preprint 197
May 1976
328 pages

New Devices, Techniques and Systems in Radar

Preprints of papers delivered at Symposium, The Hague, June 1976.

Conference Proceedings 176
August 1976
406 pages
ISBN 92-835-0173-X

Medium Accuracy Low Cost Navigation

To meet navigation requirements, system designers can select from a wide span of equipments and many system options can thus be generated. In determining which system is best to meet a given requirement many factors have to be considered. Important among these are accuracy and cost. High accuracy tends to equate with high cost; but not all navigational requirements demand high accuracy at all times. On the other hand most users are concerned to obtain systems to meet their requirements at a reasonably low cost. With this in mind the purpose of the Conference, at which 29 papers were presented, was to explore the options available for navigation systems in the medium accuracy low cost field. The papers were grouped under the following headings:– Requirements and Specifications; Radio Techniques; Non-Radio Techniques; Appropriate Navigation System Components; Total System Considerations. The Proceedings contain the papers presented and the discussions which followed. AVP meeting held in Sandefjord, Norway, September 1975.

Conference Proceedings 196
P.W.Smith (Editor)
November 1976
228 pages
ISBN 92-835-0182-9

Avionic Cooling and Power Supplies for Advanced Aircraft
The continued increase in the quantity of avionics equipment in military aircraft has already given rise to a critical situation in terms of cooling. The environment, particularly at high speed and low levels, has made the use of the airframe or the fuel as a heat sink a less profitable arrangement than in the past. Alternative solutions must be found which include both the reduction in sources of heat and more efficient methods of cooling.

This specialist meeting was designed to familiarise the NATO scientists and engineers with current research and development work in the field of cooling and electrical power supplies, to define the problem quantitatively, and to identify areas which require research.

ELECTROMAGNETIC WAVE PROPAGATION PANEL (EPP)

Conference Proceedings 173
January 1976
452 pages
ISBN 92-835-0155-1

Radio Systems and the Ionosphere
This EPP Symposium held in Athens, May 1975, was mainly concerned with the effects of the ionosphere on HF communication systems. It considered means of predicting the performance under given conditions and of making the optimum use of the ionosphere at a given time.

The ionospheric effects on the propagation of signals to and from satellites was also discussed, chiefly in connection with amplitude scintillations in communication systems, and the positional errors introduced into navigational aids. The effects on VLF and LF navigational aids were also considered.

Conference Preprint 192
March 1976
50 pages

Artificial Modification of Propagation Media
Abstracts of papers delivered at Specialists' Meeting, Brussels, April 1976.

Conference Proceedings 183
May 1976
646 pages
ISBN 92-835-0164-0

Optical Propagation in the Atmosphere
A majority of military optical systems operate in the atmosphere and their performance is often degraded by weather. For several decades researchers have studied in-depth the performance limitations imposed by the atmosphere and devised techniques to get around these problems. The purpose of this EPP Symposium, held in Lyngby, Denmark, October 1975, was to bring together and update the understanding of atmospheric optical propagation, present a comprehensive review of the state-of-the-art, and provide interaction among the key researchers in the NATO community.

Conference Preprint 208
October 1976
28 pages

EM Propagation Characteristics of Surface Materials and Interface Aspects
Abstracts of papers delivered at Specialists' Meeting, Istanbul, October 1976.

Conference Preprint 209
October 1976
52 pages

Propagation Limitations of Navigation and Positioning Systems
Abstracts of papers delivered at Specialists' Meeting, Istanbul, October 1976.

FLUID MECHANICS PANEL (FMP)

AGARDograph 160
Volume 7
E.Kottkamp, H.Wilhelm and D.Kohl
April 1976
150 pages
ISBN 92-835-1215-4

Strain Gauge Measurements on Aircraft
This AGARDograph is the seventh of the AGARD Flight Test Instrumentation Series, and is intended to give the test engineer a comprehensive description of the different aspects of strain and load measurements on aircraft. These measurements are of outstanding importance as they are the only practical means of determining material stresses during ground and flight tests.

Conference Proceedings 187
April 1976
490 pages
ISBN 92-835-0163-2

Flight/Ground Testing Facilities Correlation
These proceedings of the FMP Meeting, Valloire, France, June 1975, consist of thirty-eight papers and prepared comments on the subjects of flight and ground testing techniques and the correlation of the results obtained from various test methods. Sixteen contributions in the first session reviewed the correlation of basic windtunnel techniques and dynamic simulation methods. The second session contains seven contributions on modern flight-test techniques for correlation

including the use of conventional and RSRA as well as RPRVs and free-flight models. In the final session fifteen papers reviewed the general state-of-the-art in windtunnel/flight data correlation for a wide variety of fixed- and rotary-wing aircraft.

Conference Proceedings 198
June 1976
392 pages
ISBN 92-835-0167-5

Flight Simulation/Guidance Systems Simulation
These proceedings consist of 28 papers which were presented at a Symposium held in The Hague, October 1975, on Flight Simulation/Guidance Systems Simulation which was jointly sponsored by the Flight Mechanics and Guidance and Control Panels of AGARD. There were 6 sessions in which the current use of simulators in the following fields was described: Systems Synthesis, Approach and Landing, Aircraft Development, Air Combat, Weapon Delivery, and Mission Training. Three more sessions covered the subjects of Cues Generation, Turbulence Modelling, and some specialized simulation subjects. The concluding session was a Round Table Discussion in which the participants examined the future needs in development and use of simulators. The main conclusions of the discussion are summarized in the Preface of this volume.

Conference Proceedings 199
June 1976
256 pages
ISBN 92-835-0169-1

Stall/Spin Problems of Military Aircraft
These proceedings consist of 23 unclassified contributions to the FMP Specialists' Meeting held at the von Kármán Institute, Belgium, November 1975. There were 5 technical sessions in which the state-of-the-art in the high angle of attack regime was reviewed under the titles: the Stall/Spin Problem; Analysis and Design Techniques; Test Techniques; and Full Scale Flight Experience. There was a concluding discussion which examined the contemporary problem areas in this important aspect of aircraft design and operation. The findings and recommendations are summarized in the Preface to the proceedings.

FLUID DYNAMICS PANEL (FDP)

Conference Proceedings 168
(Supplement)
Luigi Crocco
February 1976
40 pages

Flow Separation
This publication contains one paper (*Flow Separation* by Luigi Crocco) which was presented at the *FDP Symposium on* Flow Separation held at Göttingen, Germany 27–30 May 1975. It was published as a supplement as it was not available when AGARD Conference Proceedings 168 went to press.

Report 644
J.P.Hartzuiker, P.G.Pugh,
W.Lorenz-Meyer and G.E.Fasso
D.Küchemann (Editor)
March 1976
32 pages
ISBN 92-835-1214-6

On the Flow Quality Necessary for the Large European High-Reynolds-Number Transonic Windtunnel LEHRT
LEHRT is meant to provide aerodynamic data at high Reynolds numbers of high standard in a relatively short running time (dictated by economic reasons). This implies that the flow quality in LEHRT has to be excellent. Quantitative requirements for turbulent level as well as for pressure fluctuations have been developed in this report.

Conference Proceedings 174
March 1976
512 pages
ISBN 92-835-0162-4

Windtunnel Design and Testing Techniques
These proceedings of the FDP Symposium held in London, UK, 6–8 October 1975 include forty-six papers and Round Table Discussion dealing with recent technical concepts and procedures for windtunnel design, operation, and testing techniques. Results and discussion included innovative windtunnel designs, such as the cryogenic windtunnel, the Evans clean tunnel, the Ludwieg tube, and the injector tunnel. Conventional facilities were also considered. Problem areas particularly important to the efficient design and operation of transonic, high Reynolds number transonic windtunnels were discussed and include: windtunnel wall interference, model design and mounting, aeroelastic effects, Reynolds number effects and tunnel noise. Measuring and test techniques, V/STOL techniques and other fluid motion problems for subsonic and transonic test facilities were highlighted. Numerous promising technological concepts were presented which provide the direction and opportunity for further research and development.

***Conference Preprint* 193**
April 1976
158 pages

Applications of Non-Intrusive Instrumentation in Fluid Flow Research
See Conference Proceedings 193 below.

Advisory Report 97
B.H.Goethert
August 1976
22 pages
ISBN 92-835-1222-7

Technical Evaluation Report on Windtunnel Design and Testing Techniques
This Advisory Report reviews and evaluates the FDP Symposium (see CP-174) and establishes recommendations for future research activities. It is observed that recent advanced design concepts, technologies, techniques and instrumentation have emerged which offer great potential for the development of highly sophisticated transonic windtunnel systems as well as upgrading of existing facilities. Future advanced transonic windtunnel systems will be able to incorporate such concepts and technologies as: cryogenic condition of the windtunnel gas; adjustable walls or adjustable crossflow through partially opened walls; magnetic suspension and force-and-moment measuring systems; and remote measuring and scanning systems. Additional research is required to realize the full potential of each technology area, however, sufficient knowledge is available today to initiate construction of advanced technology windtunnels with designs that will accommodate the future expected advances in test section wall technology, mounting systems, instrumentation, etc.

Conference Preprint 204
August 1976
154 pages

Prediction of Aerodynamic Loading
Preprints of papers delivered at Symposium, Moffet Field, California, September 1976.

Conference Proceedings 193
September 1976
320 pages
ISBN 92-835-0176-4

Applications of Non-Intrusive Instrumentation in Fluid Flow Research
Proceedings of the FDP Symposium held in Saint-Louis, France, May 1976. Twenty-eight papers and Round Table Discussion dealing with applications of new non-intrusive instrumentation measuring systems and techniques for subsonic, transonic, and supersonic turbulent flows. Specific attention was centered on measuring accuracies, limitations, corrections and other problem areas. Discussions indicated that future research activities should be carefully planned to concentrate on obtaining critical data to enhance our understanding of the fluid physics of turbulent flows, to develop and optimize the LDV for those applications where it has unique advantages, and to obtain redundant measurements using different techniques and measuring systems whenever possible.

Advisory Report 98
D.J.Peake and W.J.Rainbird
October 1976
18 pages
ISBN 92-835-1226-X

Technical Evaluation Report on the Fluid Dynamics Panel Symposium on Flow Separation
This report contains an evaluation and appraisal of the subject (see CP-168) with recommendations for future research. Current knowledge and understanding of the fluid physics of 2D and 3D flow separation and reattachment, particularly for turbulent flows, is limited. It is necessary that high quality, carefully planned 2D and 3D boundary layer experiments be conducted to obtain dependable experimental data to enhance our basic knowledge, and for use in verification, validation and development of theoretical prediction methods. These complete, unambiguous data sets should include detailed documentation of all measurable quantities, both mean and fluctuating, at the wall, in the viscous boundary layer and in the external flowfield. Emphasis should be placed on redundant measurement techniques to ensure high data reliability.

Conference Proceedings 210
October 1976
214 pages
ISBN 92-835-0178-0

Numerical Methods and Windtunnel Testing
Proceedings of the FDP Specialists' Meeting held at the Von Kármán Institute for Fluid Dynamics, Rhode-St-Gènese, Belgium, 23–24 June 1976, containing seventeen papers and a Round Table Discussion which focused on the role of computers in windtunnel testing. Discussions highlighted the manner in which computers can be utilized complementary with windtunnels to enhance the utility and effectiveness of both. Computer systems for windtunnel automatic real-time control, operation, and data collection-analyzation, which significantly increase operating efficiency and reduce power consumption, where discussed.

Recommendations were made for planned key experiments to obtain selected data to further validate and develop the computational methods, thus enhancing and significantly improving our prediction and design capability.

AGARDograph 222
G.Rudinger
A.Auriol (Editor)
October 1976
96 pages
ISBN 92-835-1228-6

Flow of Solid Particles in Gases
During a meeting of the AGARD Fluid Dynamics Panel held in Rome, Italy in September 1974, one day was devoted to a review of activities in various countries in the field of multiple flow of solids and gases. Five survey papers were presented by representatives of France, West Germany, United Kingdom, Belgium and the United States.

This AGARDograph includes edited versions of these five papers, which are printed in the order of their presentation at the meeting. The papers are: French Contribution to Aerodynamics of Gas-particle Mixtures (P.Kuentzmann); Gas Flows

with Solid Particles: Research and Development in Germany (W.Wuest); Review of Research in the UK in the field of Multiple Flows of Solids and Gases (R.A.Duckworth); Flow of Solid Particles in Gases: Activities at the Von Kármán Institute for Fluid Dynamics (J.J.Ginoux and M.Riethmuller); Fundamentals and Applications of Gas-Particle Flow (G.Rudinger). The AGARDograph also includes cross-references between papers, and a subject index.

GUIDANCE AND CONTROL PANEL (GCP)

AGARDograph 215
J.M.Kirshner (Editor)
January 1976
606 pages
ISBN 92-835-1207-3

Fluidics Technology
This AGARDograph is based on material presented at a Symposium on Fluidics held by the Harry Diamond Laboratories of the United States Army. It largely represents a selection of material from the Proceedings of this Symposium, edited in the interests of a wider audience. The object of the compilation is to overview in concise form the present state of research, technology and applications of fluidics. An opening section on sensors is followed by sections on circuit components, systems and signal aspects, and design and application. A final section is concerned with research and fabrication needs in the future. The table of contents of the original HDL Symposium is appended.

AGARDograph 219
February 1976
372 pages
ISBN 92-835-0157-8

Range Instrumentation, Weapons Systems Testing and Related Techniques
This special collection of papers prepared for the Guidance and Control Panel of AGARD includes twenty contributions, divided into four parts with the following headings: I. Overviews; II. Range Instrumentation Techniques; III. Range Instrumentation Systems; IV. Range Facilities and Requirements.

Conference Proceedings 188
A.Benoit and D.R.Israel
February 1976
592 pages
ISBN 92-835-0156-X

Plans and Developments for Air Traffic Control Systems
These Proceedings include the papers presented at a Symposium of the AGARD GCP held in Cambridge, Massachusetts, USA, May 1975. Forty papers were presented on the following topics: Navigation, Surveillance, Automation, Airport Capacity and Surface Surveillance, Approach and Landing, Advanced Concepts and System Performance Measures. The proceedings include Discussions, a Conference Overview and Closing Remarks.

AGARDograph 219
(Supplement) (Classified)
March 1976
32 pages

Range Instrumentation, Weapons Systems Testing and Related Techniques
This publication is a classified supplement to AGARDograph 219.

Conference Proceedings 198
June 1976
392 pages
ISBN 92-835-0167-5

Flight Simulation/Guidance Systems Simulation
These proceedings consist of 28 papers which were presented at a Symposium in October 1975 on Flight Simulation/Guidance Systems Simulation which was jointly sponsored by the Flight Mechanics and Guidance and Control Panels of AGARD, held in The Hague, October 1975. There were 6 sessions in which the current use of simulators in the following fields was described: Systems Synthesis, Approach and Landing, Aircraft Development, Air Combat, Weapon Delivery, and Mission Training. Three more sessions covered the subjects of Cues Generation, Turbulence Modelling, and some specialized simulation subjects. The concluding session was a Round Table Discussion in which the participants examined the future needs in the development and use of simulators. The main conclusions of the discussion are summarized in the Preface of this volume.

Conference Proceedings 211
(Classified)
November 1976
208 pages

Night and All-Weather Guidance and Control Systems for Fixed-Wing Aircraft
These proceedings include papers presented at the 22nd Technical Meeting of the Guidance and Control Panel of AGARD, held in Cheltenham, UK, 3–7 May 1976. Topics discussed include operational needs and problems, piloting and navigation, electro-optical sensor design, modelling, evaluation and application, approach and landing problems, and the man-machine interface and overall system design.

PROPULSION AND ENERGETICS PANEL (PEP)

Advisory Report 93
I.I.Pinkel
January 1976
42 pages
ISBN 92-835-1201-4

Future Fuels for Aviation
This report summarizes the survey of NATO nations made by Mr Pinkel on behalf of the Propulsion and Energetics Panel of AGARD. It presents a consolidation of the data gathered in almost all NATO nations through a series of interviews and correspondence. It addresses the fuel supply outlook within the NATO nations for hydrocarbon fuels as well as alternate fuels. Also discussed are possible specification changes for fuels and changes in design and operation. Included are numerous recommendations for future programs in the fuels area.

Advisory Report 94
F.Jaarsma
February 1976
16 pages
ISBN 92-835-1203-0

Technical Evaluation Report on the PEP Working Group No.4 on Improved Nozzle Testing Techniques in Transonic Flow
Summary and Conclusions on the test reports and joint analyses performed by a PEP Working Group on nozzle testing techniques. The original work from eight facilities and five nations was described in AGARDograph 208 along with an analysis of the reasons for variations in tests performed with a common model. This evaluation report provides conclusions and recommendations based on those analyses. It addresses effects of wind tunnel static pressure, Reynolds Number, boundary layer, model support, wall interference, buoyancy, afterbody geometry, nozzle pressure ratio, and jet temperature.

Conference Proceedings 177
April 1976
568 pages
ISBN 92-835-0158-6

Unsteady Phenomena in Turbomachinery
These Proceedings consist of 34 papers including the discussions after each paper, and the Round Table Discussion at the end of the Meeting for the 46th PEP Meeting held in Monterey, California, September 1975. The papers from 7 nations were divided into 6 Sessions: The Practical Importance of Unsteady Flow (3 papers), Compressor Behavior with Uniform Flow (9 papers), Compressor Response to Distorted Inflow (11 papers), Unsteady Cascade Flow Measurements (4 papers), Unsteady Cascade Flow Theory (4 papers), and Compressor Stall (3 papers). The final session was a Round Table to review problems and progress and recommend future programs. A technical evaluation report for the Meeting is also included.

Conference Preprint 194
April 1976. 68 pages

Small Solid Propellant Rockets for Field Use
See Conference Proceedings 194 and 194 (Supplement) below.

Conference Preprint 195
April 1976. 70 pages

Through Flow Calculations in Axial Turbomachinery
See Conference Proceedings 195 below.

Conference Preprint 205
August 1976. 142 pages

Variable Geometry and Multicycle Engines
Preprints of papers delivered at Meeting, Paris, France, September 1976.

Conference Proceedings 194
September 1976
156 pages
ISBN 92-835-0174-8

Small Solid Propellant Rockets for Field Use
These Proceedings consist of 25 papers, including the discussion after each paper, and a Technical Evaluation Report of the Specialists' Meeting held at the PEP Meeting in Porz-Wahn, Cologne, Germany, May 1976. The papers from seven nations were divided into five sessions: Requirements and Systems Specifications (3), Development of Small Rocket Motors (6), Thrust Vectoring and Control (3), High Performance Solid Propellants (7), and Qualification, Testing and Environmental Effects (6). Eleven papers and the Technical Evaluation Report are not included in these unclassified proceedings, but are published in a classified supplement.

Conference Proceedings 194
(Supplement) (Classified)
October 1976. 148 pages

Small Solid Propellant Rockets for Field Use
See Conference Proceedings 194 above.

Conference Proceedings 195
October 1976
242 pages
ISBN 92-835-0179-9

Through-Flow Calculations in Axial Turbomachinery
The Conference Proceedings contains the papers presented at the Propulsion and Energetics Panel Specialists' Meeting held on the 20 and 21 May 1976 at DFVLR, Porz-Wahn, near Cologne, Germany.

The purpose of the meeting was to review the current knowledge, methods and techniques available to evaluate the flow pattern at design and off-design conditions in single and multistage turbomachines, inside and outside the bladings along the meridional surfaces, concentrating on the axisymmetric approach.

The meeting comprised two review papers, seven papers on particular methods,

two papers describing the various test cases – for both compressors and turbines – which were sent to firms and institutes for calculation by different methods, and two papers discussing the results of calculations with experimental data. There was a Round Table discussion at the end of the meeting which is included herein in its entirety. Conclusions drawn from this Meeting are presented in the Technical Evaluation Report as well as suggestions for future course of actions.

STRUCTURES AND MATERIALS PANEL (SMP)

Conference Proceedings 185
January 1976
170 pages
ISBN 92-835-0151-9

Alloy Design for Fatigue and Fracture Resistance
The steady advancement of aircraft performance has been possible because of the development of alloys with increasingly higher strength/weight ratios. The increase in static strength, however, often resulted in decreased resistance to cracking due to stress corrosion, fatigue and overload. This SMP Specialists' Meeting was held in Brussels, April 1975, to deal with questions dealing with the microstructure and variations of microstructure of various aerospace alloys and the associated effects on fatigue and fracture resistance, the effects of variation in chemical composition, processing and heat treatment on microstructure, and the related possibilities of achieving higher fatigue and fracture resistance by changes in chemical composition, processing procedures and heat treatment, without serious penalties relative to static strength and corrosion resistance properties. This Conference Proceedings contains the text of six papers given at the meeting and a summary of the discussions. Aluminum, Titanium and Ferrous Alloys were covered.

Conference Proceedings 186
January 1976
202 pages
ISBN 92-835-0154-3

Impact Damage Tolerance of Structures
A Specialists' Meeting was held by AGARD in Ankara, September 1975 to stimulate collection of data for a manual, expected to be completed in late 1977, on the subject of the resistance of aircraft structure to the impact of projectiles. There is a great need to extend past AGARD work on the subject (AGARD Advisory Report AR-47 on "Physical Vulnerability of Aircraft") to include design methodology and the proposed manual is intended to do this. Among the subjects covered in this exploratory conference were: blast effects; the type of damage produced by different projectiles; the failure characteristics of the structure under load and its residual strength and lift after damage; the relationship between spread of damage, materials used, and the detail design features; the degree of projectile penetration and the related hydraulic ram effect in fuel tanks; and distribution of size, velocity and direction of engine debris fragments and their effect on structure. The relationship to improved aircraft damage tolerance of such factors as: the use of armor and deflectors; the employment of modified engine design (to cause blade failure to be more likely than disc failure and to contain a large portion of the resultant debris); the effectiveness of analysis of damaged structures; and the utilization of methods of improvement of overall aircraft layout are also considered.

Report 636
H.Tijdeman and R.Destuynder
January 1976
42 pages
ISBN 92-835-0153-5

Comments on Transonic and Wing-Store Unsteady Aerodynamics
Two papers given in September 1975 before the SMP Sub-Committee on Aeroelasticity and Unsteady Aerodynamics, are contained in this Report. The first presents an in-depth review of the present state-of-the-art in transonic unsteady aerodynamics. Some of the most advanced methods are discussed and evaluated. An illustration of typical effects occurring in high subsonic and transonic flow around oscillating airfoils and wings is presented. Some useful conclusions are drawn. The second paper contains a description of measurements made on a variety of wing-store combinations, and compares these measurements with theoretical values derived from two different methods, one developed by ONERA and the other by NLR. A conclusion regarding the main factor affecting variation in lift coefficients of wings-with-stores is drawn.

Report 637
J.Roustan
January 1976
20 pages
ISBN 92-835-2101-3

Comparaison des Fonctions de Transfert Calculées et Mesurées sur l'Avion Concorde
This Report was given as a pilot paper in October 1975 before the new group within the SMP dealing with Structural Aspects of Active Controls. The paper was heard with the intent that it might aid the group in determining the direction its work should take in the future. As such, it contains a comprehensive and

detailed analysis of the comparison between calculations and actual in-flight measurements of the transfer functions of the Concorde Supersonic Transport aircraft through atmosphere turbulence at differing altitudes and speeds. Numerous graphs and charts are presented. Although the basic conclusion of the work is that the aircraft presently defies an effective analysis of its reponse to turbulence, it presents an area of work which the Active Controls group may find quite fertile for possible future efforts.

Report 639
I.C.Taig, A.August, R.Hadcock and S.Dastin
January 1976
24 pages
ISBN 92-835-0152-7

Design of Structures in Composite Materials (Basic Data and Interdisciplinary Action)
The two papers that are contained in this Report were given as pilot papers in October 1975 before the group within the SMP dealing with Composite Materials. The papers were heard with the intent that they might aid the group in determining the direction its work should take in the future. The first of these papers, by Mr I.C.Taig, points out and defines the three levels of materials data (Acceptance data, Materials Characterization data and Design data) that he believes are needed to establish a design and manufacturing process that will allow the safe and efficient use of composite materials. The paper points out some of the gaps between characterization and design, and it proposes some types of testing and data that may fill these gaps. It proposes that the present burdensome requirement that every primary composite component have its own development program can be eliminated if components are built in standardized ways from a finite family of layups and using previously developed structural elements. The second paper by Mr A.August points out the vastly increased significance of the design engineering/materials engineering interface in the development of advanced composite structures. To achieve a smooth-working design/materials interface, the paper suggests long-term emphasis in three specific areas: Education (on the industrial level and also back to the colleges and universities); interdisciplinary development of advanced composites; and development of composites test standards.

Report 640
J.E.Holpp and M.A.Landy
January 1976
36 pages
ISBN 92-835-1202-2

The Development of Fatigue/Crack Growth Analysis Loading Spectra
A realistic loading spectrum is a necessity in order to predict the fatigue or crack growth life of a component. Realistic loading spectra encompass many disciplines, including loads, stress, fatigue and crack growth analysis, and the realism of the spectrum will be dependent on the accuracy of the input data and the degree of complexity that the analyst is able or willing to undertake. External factors such as time and money considerations, available data, degree of accuracy required, etc., also affect the process of spectrum development and these factors often force the use of simpler, less time consuming, less expensive techniques than those desired to produce adequately realistic results. Steps in developing a loading spectrum which are covered in this Report include: mission profile definition; loading environment; loading conditions; structural loads analysis; stress analysis; and stress sequencing. The simpler techniques available are discussed whenever appropriate. A detailed example of a spectrum development on a fighter/strike aircraft is included.

Advisory Report 92
R.D.J.Maxwell
January 1976
14 pages
ISBN 92-835-1205-7

Current Standards of Fatigue Test on Strike Aircraft
The major fatigue test constitutes one of the most important aspects in almost all modern tactical aircraft designs. Within NATO, where numerous different tactical aircraft are employed, and where several user nations may operate an aircraft built by a different nation, it is important that the major fatigue test be performed in such a manner that the results can be interpreted and used by the various countries concerned. At present, within NATO, there is a very wide variation in the manner in which major fatigue tests are conducted and in the information sought and recorded during these tests. There is a need for a set of guidelines that all NATO nations might follow which will make any major fatigue test performed on any new NATO aircraft a better test and make the data derived from it more universally usable by the NATO member nations. This Advisory Report, therefore, presents a statement of the objectives of a fatigue test, a list of essential steps needed to achieve the objectives, a summary of recommendations of the way the steps should be carried out and a review of the background philosophy behind the recommendations.

Report 638
K.L.Reifsnider
February 1976
28 pages
ISBN 92-835-1204-9

Fatigue in Composite Materials
The information in this Report was originally given as a lecture in Turkey, France, Belgium, Norway, Netherlands and Germany under the AGARD Consultants and Exchange Program. Because of its very favorable reception, a decision was made to publish the text as an AGARD Report under the Sponsorship of the AGARD SMP. The Report deals with the extremely difficult task of defining, analyzing and combating fatigue or fatigue damage in composite materials. A general descriptive overview of fatigue of composites from the standpoint of basic characteristics and concepts (and in particular the fatigue behaviour of more familiar materials) is presented. Current understandings and practices related to the problem which have the greatest possible generality are explored.

Report 643
W.P.Rodden
February 1976
68 pages
ISBN 92-835-1210-3

A Comparison of Methods used in Interfering Lifting Surface Theory
This report contains a summary and comparison of methods used to predict flow fields adjacent to and airloads acting on oscillating interfering lifting surfaces. Both subsonic and supersonic speeds are considered. A number of configurations and parameters were established by the SMP. The configurations included specific geometries and combinations of wing, horizontal tail and fin and the parameters varied included Mach number, reduced frequency, mode of oscillation and flow field region. AGARD Members then voluntarily made calculations for the established configurations and parameters using the methods operational in their countries. Five countries contributed and the individual results, comparison and analysis are contained in this Report.

Advisory Report 96
W.J.Mykytow
February 1976
14 pages
ISBN 92-835-1209-X

Technical Evaluation Report of AGARD Specialists Meeting on Wing-with-Stores Flutter
The carriage of stores on wings significantly changes their dynamic characteristics and often adversely affects their flutter properties as a result of reduced wing frequencies and the introduction of critical frequency ratios together with inertia, elastic and aerodynamic coupling between loads. Adverse flutter characteristics and significantly lowered flutter speeds occur and these restrictions severely constrain the speed – altitude performance envelope that can be achieved by an aircraft. The variety of stores that can be carried on modern tactical airplanes generates a need to accurately evaluate the literally thousands of possible store combinations which can be carried by such aircraft. An AGARD Specialists' Meeting held in October 1974 had as its goal the presentation and discussion of latest information procedures in use in the various NATO nations to solve the flutter problems associated with the carriage of external stores on wings. The Proceedings of the Specialists' Meeting are published as Conference Proceedings No.162. This Technical Evaluation Report assesses the Conference, summarizes the nine presentations given, draws conclusions from the information exchanged and makes various recommendations concerning possible future efforts on the subject.

Report 645
March 1976
92 pages
ISBN 92-835-0161-6

Unsteady Aerodynamics
The FDP will hold a Symposium in Fall 1977 on the subject of "Unsteady Aerodynamics". As a means of examining the potential value of various subjects for future Panel projects, the FDP often organizes a "Round Table" Meeting on the subject where several exploratory presentations are given and discussed. For the Round Table on Unsteady Aerodynamics, the SMP was asked to make contributions which were relevant to the domain of aeroelasticity, an area in which SMP has been vitally interested and active since its formation. Five papers were thus presented covering such topics as calculation methods in unsteady aerodynamics, recent research results in transonic flow, unsteady rotor blade aerodynamics, wind tunnel test techniques, and recent research efforts in aeroelasticity and unsteady aerodynamics at the US Air Force Flight Dynamics Laboratory. These papers gave a succinct review of the present state of aeroelasticity-oriented unsteady aerodynamics. They were compiled by SMP and are presented in their entirety in this Report.

Report 641
P.W.Sutcliffe
June 1976
12 pages
ISBN 92-835-1220-0

Review of Advanced Powder Metallurgical Fabrication Techniques in European NATO Countries
This Report, written subsequent to the author's completion of a coordination visit to various European firms which are engaged in powder metallurgical operations, identifies those agencies so engaged, summarizes the nature and extent of their activities, and evaluates the present state-of-the-art of Powder Metallurgy. The Report concentrates on the various hot consolidation techniques currently being investigated for the fabrication of titanium and nickel alloys in high-integrity, highly stressed aero-engine components.

Report 646
June 1976
58 pages
ISBN 92-835-0170-0

Structural Identification on the Ground and in Flight including Command and Stability Augmentation System Interaction

The four papers which comprise this report were delivered at the SMP Meeting Ottawa, April 1976. They are all concerned in some way with the comparison between the mathematical model of the airplane and its actual behaviour on the ground or in flight. New structural testing methods are presented, which make it possible to provide the designer with accurate results for comparison with the finite element description of the structure, and with corrections to this model. A summary is given of the work done on the MRCA, from the design stage to the flight flutter test, to understand and analyse the aeroelastic phenomena. New reduction techniques which greatly improve the accuracy of flight flutter test results are presented. The final paper shows how the problem of interactions between the aircraft structure and the command and stability augmentation system has been solved on the MRCA.

Conference Proceedings 206
August 1976
72 pages
ISBN 92-835-0172-1

Helicopter Design Mission Load Spectra

As mission requirements cause the utilization of any helicopter fleet to vary significantly over the fleet's life time, the problem of predicting the structural life of fatigue-critical components becomes more complex.

A prime factor in the inability to accurately predict component lives is the lack of adequate mission load-spectra data, which is compounded by the increased aircraft performance that has resulted in more sophisticated mission profiles. The impact of the fatigue spectra on life has been well documented showing that, for the same load levels, merely changing loading sequence dramatically changes the number of cycles to failure. A more accurate representation of the effects of not only load levels but load sequence will provide more realistic fatigue analyses and life predictions.

In order to stimulate the collection of such data and to pool the approaches of the helicopter-producing NATO Nations, a SMP Specialist Meeting was held in Ottawa, Canada, April 1976. The presentations, an overview and the subsequent discussions are published in this volume. Among the subjects covered are the development of load spectra for design, the adaptation of this for life predictions in the field, and mission load data gathering techniques.

Report 647
C.G.Lodge and H.Schmid
September 1976
22 pages
ISBN 92-835-1223-5

Unsteady Pressures due to Control Surface Rotation at Low Supersonic Speeds – Comparison between Theory and Experiment

This paper was presented during the 42nd Meeting of the Structures and Materials Panel in Ottawa in April 1976. It deals with a serious difficulty in unsteady aerodynamics, that is the prediction of the pressure field induced by the rotation of a control surface. Much work has already been done on this subject in subsonic flow, but this is one of the first approaches to the supersonic problem. Predictions have been made by two methods developed separately by BAC and MBB. They have been compared with windtunnel tests made at NLR using more than 80 pressure tubes. Pressure distributions, hinge moments and lift have been measured for different sections of the wing. As the two theories that have been used are linearised, the agreement between theory and experiment is not perfect but appears to be adequate for flutter speed prediction.

Report 648
September 1976
22 pages
ISBN 92-835-1224-3

Advances in Engine Burst Containment and Finite Element Applications to Battle-Damaged Structure

Aircraft must be designed to sustain damage arising from the impact of a variety of types of projectiles such as military weapons and debris from engine disintegration. Recognising the need for the collection and dissemination of information on this topic, the SMP has set up a Working Group on the Impact Damage Tolerance of Structures charged with the task of producing a Design Manual. A specialist meeting was held in Ankara, Turkey in September 1975 and the conference proceedings were published as AGARD-CP-186. Two further papers were presented to a session of the Working Group in April 1976. The paper by Messrs. Bristow, Davidson and Gerstle reviews some recent research into the application of fragment impact studies to an understanding of engine burst fragment impacts and the initial development of an engine burst containment system. The paper by Dr Huang describes a method of analysis of a battle-damaged structure using the NASTRAN structural analysis program supplemented by preprocessors designed to automatically generate input data; a "patching technique" is then used in the development of a finite element model truly representing a battle-damaged structure.

Conference Proceedings 200
November 1976
266 pages
ISBN 92-835-0171-3

Advanced Fabrication Techniques in Powder Metallurgy and their Economic Implications

The purpose of this meeting was to consider the economic achievements of powder metallurgy techniques as well as the technological techniques. Cost reduction and improved materials qualities were given equal priority.

The first part of the proceedings was concerned with powder production. Four different processes of centrifugal atomization techniques for manufacture of titanium alloys were presented together with description of Argon and vacuum atomization processes for nickel base superalloys.

The second part reported on the state-of-the-art of techniques for consolidation of titanium and superalloy powders to near net shapes, discussion also including all stages of the production sequence – powder handling, canning techniques, consolidation, secondary metal-working and thermal treatments.

Recommended areas for further R & D work were discussed.

Report 650
W.P.Rodden
November 1976
12 pages
ISBN 92-835-1230-9

State-of-the-art in Unsteady Aerodynamics

The accurate prediction of unsteady air loads is essential to avoiding problems and assuring safety in the many interdisciplinary regions involving aeroelasticity and the dynamics of active controls. However, the methods to predict such air-loads are complex and intricate. It was considered essential to specify standard configurations and parameters, and to encourage pioneering NATO scientists to report their results early. This would provide bases for evaluation and improvement of later and following developments by other countries. The first co-operative effort involved isolated surfaces in subsonic and supersonic flow, and is reported by D.L.Woodcock in AGARD Report No.583 ("A Comparison of Methods Used in Lifting Surface Theory", 1971). The noticeable success led to another effort on interfering lifting surfaces and is reported by W.P.Rodden in AGARD Report No.643 ("A Comparison of Methods Used in Interfering Lifting Surface Theory", 1976). Both are supplements to the AGARD Manual on Aeroelasticity, Vol.VI. The latter effort and report has also proved to be highly successful.

New developments are rapidly emerging in unsteady aerodynamics. The aeroelastician will continue heavy reliance on prediction of airloads from theoretical methods. A terse description of the new state of the art was required and has been very competently provided by Dr Rodden in this report.

Report 651
December 1976
60 pages
ISBN 92-835-1232-5

Mechanical Properties of Ceramics for High Temperature Applications

The Structures and Materials Panel of AGARD has been actively involved in high temperature materials and their mechanical properties for a number of years. The Panel organized a Working Group on High Temperature Material Testing in 1966, and in 1971 published its results on a cooperative creep testing program as AGARD Report 581. The Panel followed up that activity by forming a Working Group on Low-Cycle High Temperature Fatigue. The Group first undertook a survey of current activities and test methods used in this field, published as AGARD Conference Proceedings 155. The Panel's current Sub-Committee on High Temperature Materials is conducting, as its primary activity, a cooperative program on the characterization of low-cycle, high temperature fatigue by strain-range partitioning techniques. In view of the current interest in ceramics for use in high temperature turbine engine applications in many of the NATO nations, however, the Sub-Committee has undertaken several activities in this area as well.

Two invited papers on analytical techniques for the determination of localized stresses and strains and the application of fracture mechanics, proof testing, and life prediction techniques to ceramics were presented at the Panel's 40th Meeting in April 1975 and published as AGARD Report 634. Three additional papers were invited for presentation at the 43rd Meeting in October 1976 and are published in this report. These papers covered in greater detail the fracture mechanics, high temperature creep properties, and design aspects of ceramic materials.

Report 652
G.Haidl
December 1976
22 pages
ISBN 92-835-1231-7

Non-Linear Effects in Aircraft Ground and Flight Vibration Tests

Examples of non-linear vibration behaviour in ground resonance tests of an aircraft are shown. Model tests for a simplified system with non-linear properties have been performed, to study the effects of friction and backlash with respect to ground resonance test and flight flutter test.

With symmetric and asymmetric non-linear stiffness characteristics effects of amplitude dependent frequencies, mode coupling, mode asymmetries and the consequences in parameter identification in vibration tests are pointed out and discussed.

Advisory Report 99
R.B.Baird
December 1976
14 pages
ISBN 92-835-1235-X

Summary of the Discussions on Structural Design Technology
This paper presents the results of the discussions held during the 40th through the 42nd meeting of the Structures and Materials Panel (SMP) by the Structural Design Technology Group. The objective of the Group was to discuss design problems and questions created by new structures technology, guide future SMP activities towards the solution of those problems, and identify promising co-operative efforts to be accomplished within the NATO community.

It is apparent that the Structural Design Technology group fulfilled, in all respects, the goals that were initially established. The technologies that are the basis for the majority of concerns expressed during the total life of the Group are Composite Structures, Fracture Mechanics and the new USAF Safety Design philosophy. It is recommended that a cooperative program be established in the SMP to gather, analyse and disseminate existing crack propagation data for various structures fabricated from conventional and composite materials. Final output would be a source of data for the structural designer.

TECHNICAL INFORMATION PANEL (TIP)

AGARDograph 216
D.A.Bush and J.A.Weaver
March 1976
36 pages
ISBN 92-835-1211-1

OCR and its Application to Documentation – A state of the art review
This AGARDograph attempts to survey the problems, both practical and economic, of producing Scientific and Technical Documentation, and to indicate how the application of Optical Character Recognition (OCR) could help. The function and method of operation of OCR machines are described in outline, and the limitations are discussed. Recommendations are given for improving documentation production, and areas for further research are suggested.

Conference Proceedings 179
March 1976
126 pages
ISBN 92-835-1213-8

The Problem of Optimization of User Benefit in Scientific and Technological Information Transfer
A TIP Meeting was held in Copenhagen, October 1975, to investigate the user/service interface and to define users' problems particularly for aerospace, scientific and technical information. User population and their needs were examined with the view to system designers and managers providing services to meet these requirements.

Conference Preprint 207
September 1976
144 pages

Advancements in Retrieval Technology as Related to Information Systems
See Conference Proceedings 207 below.

Conference Proceedings 207
December 1976
162 pages
ISBN 92-835-0183-7

Advancements in Retrieval Technology as Related to Information Systems
The ultimate test of any information system is whether or not the user can quickly, easily and comprehensively obtain relevant information stored therein. As data bases expand and multiply, retrieval technology must advance if the user is to benefit fully from this increased information potential. For this reason, three of the four sessions of this meeting, covering minicomputers, bibliographic data base sharing and future technological advances, explore in some depth areas critically important to the user's need to access an increasing number of scientific and technical information collections with greater ease and efficiency.

The other session was somewhat differently oriented and addresses numerical data bases, a relatively new and rapidly expanding addition to information systems. Presentations include not only the development of such data collections but several applications as well.

Report 649
A.K.Gillis
December 1976
26 pages
ISBN 92-835-1233-3

Methodology of Large Dynamic Files
This report discusses what constitutes a file system, how it evolves and where special emphasis needs to be placed in its design and implementation. Although generalized file systems are considered where possible, digitally oriented files are preferentially covered. Emphasis is also placed on the physically immense files.

The file functions of collection, conversion, storage and retrieval are presented and the file cycle associated with a data element is discussed on the basis of a generalized file system. Also discussed are file system objectives and their importance in the definition of an implementation configuration.

LECTURE SERIES

Lecture Series 81
March 1976
170 pages
ISBN 92-835-0159-4

Avionics Design for Reliability

Most of today's modern systems are dependent on the proper performance of a rather complex complement of electronic equipment. World technology has demonstrated that survivability related to reliability can be designed, predicted, monitored, tested and controlled. However, it is desirable to compare the expected total reliability programme cost with the benefits to be gained from having higher than essential reliability: some avionic failures will be catastrophic, some only critical, some of marginal importance. In every NATO Nation experts have the responsibility of choosing avionics equipment not only from the mission requirement standpoint, but also from the point of view of reliability. To satisfy this need, this Lecture Series on Avionics Design for Reliability was presented. This material was assembled to support a Lecture Series presented in Germany, UK and US in April 1976.

Lecture Series 82
March 1976
190 pages
ISBN 92-835-0160-8

Practical Aspects of Kalman Filtering Implementation

This Lecture Series No.82, on the subject of Practical Aspects of Kalman Filtering Implementation was intended to emphasize the practical aspects of the use of optimal filters in guidance, navigation and control systems. All of the Lecturers for this Series have many years of experience in the field, and they relate their experiences on various projects involving implementation techniques and problems with optimal filters. The Lecture Series aims to provide an account of how optimal filters are actually designed and implemented in practice. The techniques should be applicable to a wide variety of situations. This material was assembled to support a Lecture Series presented in Norway, The Netherlands and Italy in May 1976.

Lecture Series 83
June 1976
170 pages
ISBN 92-835-1219-7

Modern Prediction Methods for Turbomachinery Performance

Propulsion system development costs may be significantly reduced by improvement of methods for prediction of compressor and turbine component performance, and by preliminary study of the interactive operation of compressors and turbines with other system components. After the build-up of development engines, it is necessary to understand and carefully plan the process of rematching of components for optimum system performance.

AGARD Lecture Series Number 83 includes lectures and a panel discussion on the historical background of turbomachine performance prediction, on current procedures for estimation of overall and blade row performance characteristics, and on qualitative and quantitative turbomachine performance information needed for evaluation of the effects of compressor and turbine behaviour on the complete propulsion system. The lectures on component performance prediction cover both current and developing technology for axial-flow compressors and turbines, centrifugal compressors and radial-inflow turbines. This material was assembled to support a Lecture Series presented in Germany and UK in June 1976

Lecture Series 84
September 1976
164 pages
ISBN 92-835-0175-6

The Theory, Significance and Prevention of Corrosion in Aircraft

The true annual cost of corrosion in NATO aircraft is appallingly large, in spite of the advanced state of knowledge in this field. Interruption and reduction of service, failure of mission, hazards to personnel because of operating failures are additional important factors when assessing corrosion impact. Yet, most premature corrosion damage and failures occur for reasons already well-known, and to a major degree could be prevented by proper and timely appreciation of the problem and threat, and by the use of known preventive methods. Clearly, greater visibility of the problems, expanded engineering education and better practical transfer of technology and knowledge are needed. This Lecture Series was structured with this situation in mind. It covers the significance, implications and economics of corrosions, and the threats and preventive measures for the product life cycle: design, material selection, construction, maintenance and repair, inspection and test. The material in this publication was assembled to support a Lecture Series presented in the US, the Netherlands and Portugal in October 1976.

Lecture Series 85
September 1976
60 pages
ISBN 92-835-1225-1

Review of Developments in Computer Output Microfilm (COM) and Micrographic Technology, Present and Future

This Lecture Series starts with the presentation of an up-to-date review of micrographic technology, Computer Input Microfilm (CIM) and Computer Output Microfilm (COM), as well as an indication of the market size and growth rate.

After an account of the fundamentals of micrographics, COM recording techniques and recorders are described and CIM techniques reviewed. Other lectures cover indexing and retrieval techniques, systems design, alphanumeric and graphic applications. In a final paper, future trends in micrographic technology are indicated. This material was assembled to support a Lecture Series presented in Norway, France and UK in October–November 1976.

Lecture Series 80
(Preprint)
November 1976
314 pages

Aerodynamic Noise
Preprint of papers presented at the von Kármán Institute, Brussels, in December 1976.

MILITARY COMMITTEE STUDIES

Advisory Report 88
Volume I
(Classified)
July 1976
48 pages

Use of Precision Positioning Systems by NATO
The study, published in two volumes, concentrates on an evaluation of the potential applications within NATO of a precision positioning system (PPS) – as exemplified by the US NAVSTAR Global Positioning System – with special emphasis on a qualitative and quantitative evaluation of the impact of increased position information accuracy on the tactical air attack capability of NATO in Europe in the 1980's and beyond.

The study concludes that a secure and very precise PPS (less than 10 metres in the three dimensions) is feasible. With such a system, the all-weather attack capability on quasi stationary targets is so promising that continuing operational analyses should be performed. Moreover, in the specific area of guidance of manned and unmanned aircraft, as well as stand-off missiles, PPS could lead to outstanding simplifications and money savings. However, the study also identifies the need for a unified command, control, and communications system. (C^3 system).

AGARD HEADQUARTERS

Bulletin 76/1
January 1976
76 pages

Meetings – Publications – Membership
This issue of the AGARD Bulletin gave a schedule of meetings to be held in 1976, a list of publications issued in 1975 and a directory of AGARD members as of 1 January 1976.

February 1976
58 pages
ISBN 92-835-1212-X

Eleventh AGARD Annual Meeting
The Eleventh AGARD Annual Meeting was hosted by the Canadian Government in the Government Conference Centre, Ottawa, Canada on 18 September 1975. The Welcoming Address was delivered by Dr L.J.L'Heureux, Chairman of the Defence Research Board, Canadian Department of National Defence. Seven speakers presented papers as follows: Organization and Strategy, Air Command, Canada, Lieutenant General W.K.Carr, Commander, Air Command, Canada; Canadian Military Air Materiel Requirements, Major General D.W.Goss, Chief of Engineering and Maintenance, Department of National Defence, Canada; Research and Development in Support of Canadian Military Air Requirements, Mr E.J.Bobyn, Chief, Research and Development, Department of National Defence; Canadian Research and Development Policies, Dr J.D.Keys, Vice-President (Programs), National Research Council of Canada; STOL Developments, Mr J.P.Uffen, Chief Engineer, Research and Development, The De Havilland Aircraft Company of Canada, Limited; Overview of the Canadian Ministry of Transport's STOL Demonstration, Mr F.C.Black, Manager, STOL Project Office, Canadian Air Transport Administration, Ministry of Transport; Transversely Excited Atmospheric (TEA) – CO_2 Laser Development and Applications, Dr J.Gilbert, Director, Electro-Optics Division, Defence Research Establishment Valcartier, Department of National Defence. This publication reports the texts of these addresses.

AGARD History 1952–1975
February 1976
196 pages

The first edition of the AGARD History covering the years 1952 to 1968 proved to be of considerable interest and value to those concerned with the evolution of NATO and its institutions. In the AGARD community, the History has been especially useful in providing members and other participants with an overview of AGARD's background, past activities and organization. In response

to widespread demand for an updated History, and with the concurrence of Dr Wattendorf, Editor of the first edition, this new edition was published to include information up to the end of 1975.

March 1976
86 pages

Director's Annual Report to the North Atlantic Military Committee 1975
The Report covers the AGARD 1975 Technical Programme. Achievements are reported in terms of: the meetings which were held to bring together the leading personalities of the NATO nations in a particular field of science and technology for the common benefit of the NATO Community; publications initiated for the purpose of assisting member nations in the effective use of their research and development capabilities; and the budget that supported this stimulus to the advances in the aerospace sciences relevant to strengthening the common defence posture.

Highlights 76/1
March 1976
32 pages

This booklet is the seventh of a series aimed at establishing a more direct and informal means of communication between members of the AGARD community and their friends in the international aerospace profession. Items for publication are invited from all interested readers, and it is hoped that the Highlights will contain articles on the future activities of AGARD and provide a forum for the discussion of matters relating to AGARD's activities.

June 1976
32 pages
ISBN 92-835-0170-0

Technical Presentations on Scientific and Technological Forecasting
This publication contains three papers on Scientific and Technological Forecasting delivered at the Technical Presentations Session of the AGARD Spring 1976 National Delegates Board Meeting. The papers are by Admiral Sir Peter Hill-Norton, Chairman, North Atlantic Military Committee; Ingénieur Général Jean Carpentier, Directeur Adjoint, Direction des Recherches et Moyens d'Essais, Ministère de la Defence, France, (with translation); and Dr Leonard Roberts, Director of Aeronautics and Flight Systems, NASA Ames Research Center, USA.

Bulletin 76/2
July 1976
36 pages

Technical Programme 1977
This Bulletin reported the content and scope of the 1977 AGARD Technical Programme approved during the AGARD National Delegates Board Meeting, March 1976.

Highlights 76/2
September 1976
20 pages

See Highlights 76/1 above.

SECTION III

AGARD MEMBERSHIP LISTS

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- NATIONAL DELEGATES
- STEERING COMMITTEE MEMBERS
- NATIONAL COORDINATORS
- PANEL MEMBERS
- AEROSPACE APPLICATIONS STUDIES COMMITTEE MEMBERS
- AGARD STAFF

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Calendar of AGARD Technical Meetings 1977

NORTH ATLANTIC TREATY ORGANIZATION

CALENDAR OF AGARD MEETINGS – 1977

Date	*Location*	*Activity*	*Type of Meeting/Subject*
21–23 March	BELGIUM (Brussels)	Fluid Dynamics/VKI	Lecture Series No.86 **Computational Fluid Dynamics**
25–27 April	UNITED STATES (Dayton)	Fluid Dynamics	Lecture Series No.86 **Computational Fluid Dynamics**
23–25 March	FRANCE (Paris)	Headquarters	42nd **National Delegates Board Meeting** 24th **Steering Committee Meeting** 22nd **Panel Chairmen Meeting** 7th **National Co-ordinators Meeting**
28 March/ 1 April	NETHERLANDS (The Hague)	Propulsion & Energetics	49th Panel Meeting/Specialists' Meetings **Secondary Flow in Turbomachines** **Power Plant Reliability**
14–15 April	UNITED STATES (Griffiss AFB)	Avionics	Lecture Series No.87 **Microprocessors and Their Applications**
18–19 April	UNITED KINGDOM (London)	Avionics	Lecture Series No.87 **Microprocessors and Their Applications**
21–22 April	GERMANY (Munich)	Avionics	Lecture Series No.87 **Microprocessors and Their Applications**
17–22 April	PORTUGAL (Lisbon)	Structures & Materials	44th Panel Meeting/Specialists' Meetings **Unsteady Airloads in Separated and Transonic Flow** **Structural Aspects of Active Controls**
18–22 April	GERMANY (Porz-Wahn)	Aerospace Medical	Specialists' Meetings **Methods to Assess Workload** **Studies on Pilot Workload** **The Use and Abuse of Social Drugs**
2–5 May	DENMARK (Copenhagen)	Fluid Dynamics	40th Panel Meeting/Symposium **Laminar-Turbulent Transition**
2–11 May	NETHERLANDS (The Hague)	Aerospace Applications Studies Committee	Aerospace Applications Studies Committee Meeting No.13 and Working Groups
9–13 May	GERMANY (Stuttgart)	Guidance & Control	24th Panel Meeting/Symposium **Applications of Advances in Navigation to Guidance and Control**
16–20 May	UNITED KINGDOM (London)	Electromagnetic Wave Propagation	Symposium **Optical Fibres/Integrated Optics and Their Military Applications** (Joint with Avionics Panel)
16–20 May	UNITED KINGDOM (London)	Avionics	33rd Panel Meeting/Symposium **Optical Fibres/Integrated Optics and Their Military Applications** (Joint with Electromagnetic Wave Propagation Panel)
16–20 May	UNITED STATES (Moffett Field, Ca)	Flight Mechanics	50th Panel Meeting/Symposium **Rotorcraft Design**
6–7 June	NORWAY (Bolkesjø)	Guidance & Control	Lecture Series No.89 **Task Oriented Flight Control Systems**
9–10 June	UNITED KINGDOM (London)	Guidance & Control	Lecture Series No.89 **Task Oriented Flight Control Systems**
14–15 June	UNITED STATES (Dayton)	Guidance & Control	Lecture Series No.89 **Task Oriented Flight Control Systems**
22–24 June	NORWAY (Lysebu)	Technical Information	30th Panel Meeting/Symposium **The Impact of Future Developments in Communications, Information Technology and National Policies on the Work of the Aerospace Information Specialist**
25–26 August	UNITED STATES (Trenton, N.J.)	Propulsion & Energetics	Lecture Series No.90 **Laser Optical Measurement Methods for Aero Engine Research and Development**

Date	*Location*	*Activity*	*Type of Meeting/Subject*
30–31 August	UNITED KINGDOM (London)	Propulsion & Energetics	Lecture Series No.90 **Laser Optical Measurement Methods for Aero Engine Research and Development**
5–6 September	ITALY (Urbino)	Propulsion & Energetics	Lecture Series No.90 **Laser Optical Measurement Methods for Aero Engine Research and Development**
14–16 September	DENMARK (Copenhagen)	Headquarters	13th Panel Meeting/Symposium 43rd **National Delegates Board Meeting** 25th **Steering Committee Meeting** 23rd **Panel Chairmen Meeting**
19–23 September	TURKEY (Ankara)	Propulsion & Energetics	50th Panel Meeting/Symposium **High Temperature Problems in Gas Turbine Engines**
25–30 September	NORWAY (Geilo)	Structures & Materials	45th Panel Meeting/Symposium **Non-Destructive Inspection (NDI) Relationships to Aircraft Design and Materials**
26–30 September	CANADA (Ottawa)	Fluid Dynamics	41st Panel Meeting/Symposium **Unsteady Aerodynamics**
3–4 October	NORWAY (Oslo area)	Electromagnetic Wave Propagation	Lecture Series No.88 **Application of Remote Sensing to Ocean Surveillance**
6–7 October	NETHERLANDS (Den Helder)	Electromagnetic Wave Propagation	Lecture Series No.88 **Application of Remote Sensing to Ocean Surveillance**
11–12 October	ITALY (Rome)	Electromagnetic Wave Propagation	Lecture Series No.88 **Application of Remote Sensing to Ocean Surveillance**
3–7 October	ITALY (Florence)	Flight Mechanics	*51st Panel Meeting and Inter-*Panel Symposium **Fighter Aircraft Design** (with ASMP, AVP, FDP, GCP, PEP, SMP)
3–7 October	UNITED STATES (Cambridge)	Electromagnetic Wave Propagation	24th Panel Meeting/Specialists' Meeting **Aspects of Electromagnetic Scattering in Radio-communications**
11–13 October	FRANCE (Paris)	Flight Mechanics	Specialists Meeting **Performance Prediction Methods**
10–14 October	CANADA (Ottawa)	Avionics	34th Panel Meeting/Symposium **Impact of Charge Coupled Devices and Acoustic Wave Devices on Signal Processing and Imagery in Advanced Systems**
17–21 October	UNITED STATES (Dayton)	Guidance & Control	25th Panel Meeting/Symposium **Guidance and Control Design Consideration for Low Altitude and Terminal Area Flight**
17–18 October	UNITED KINGDOM (London)	Structures & Materials	Lecture Series No.91 **Advanced Manufacturing Techniques in Joining of Aerospace Materials**
20–21 October	GERMANY (Munich)	Structures & Materials	Lecture Series No.91 **Advanced Manufacturing Techniques in Joining of Aerospace Materials**
24–25 October	DENMARK (Lyngby)	Structures & Materials	Lecture Series No.91 **Advanced Manufacturing Techniques in Joining of Aerospace Materials**
24–28 October	UNITED KINGDOM (London)	Aerospace Medical	34th Panel Meeting/Specialists' Meetings **Prospective Medicine Opportunities in Aerospace Medicine** **Specific Findings in Cardiology and Pulmonary Function with Special Emphasis on Assessment Criteria for Flying**
7–17 November	FRANCE (Paris)	Aerospace Applications Studies Committee	Aerospace Applications Studies Committee Meeting No.14 and Working Groups

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